





INSTRUMENT DIVISION

PROGRAMMER

DOCUMENT NO. 120071-01

OPERATING AND SERVICE MANUAL



**SYSTRON
DONNER**
INSTRUMENT DIVISION

**SYSTRON DONNER
INSTRUMENT DIVISION**
2727 Systron Drive
Concord, California 94518
WARRANTY POLICY

I Warranty

Systron Donner Instrument Division warrants that at the time of shipment the products manufactured by Systron Donner and sold hereunder will be free from defects in material and workmanship and will conform to the current specifications published by Systron Donner's Instrument Division.

II Warranty

- A The warranty period will be one year from the date of shipment. This warranty is extended only to the original buyer.**

III Warranty Adjustments

- A** If any defect within this warranty appears, Purchaser shall notify Seller immediately.
- B** Systron Donner agrees to repair or furnish a replacement for, but not install, any product which within the standard warranty shall, upon test and examination by Systron Donner, prove defective within the above warranty period.
- C** No product will be accepted for return or replacement without prior approval of Systron Donner. Upon such authorization and in accordance with instructions of Systron Donner, the product will be returned to the manufacturing location, shipping charges prepaid by Purchaser.

IV Exclusions from Warranty

- A** The foregoing warranty is in lieu of and excludes all other expressed or implied warranties of merchantability or fitness or otherwise.
- B** Systron Donner will not be liable for any special or consequential damages or for loss, damages or expense directly or indirectly arising from the use of the products, or any inability to use them either separately or in combination with any other equipment or material, or from any other cause.
- C** The warranty does not extend to any product manufactured by Systron Donner which has been subjected to misuse, neglect, accident, improper installation or to use in violation of instructions furnished by Systron Donner.
- D** The warranty does not extend to or apply to any unit which has been repaired or altered at any place other than Systron Donner; by persons not expressly approved by Systron Donner; not to any unit, the serial number of which has been removed or defaced or Changed.
- E** This warranty applies to new equipment only and will cover repaired or replacement items only to the extent of the balance remaining of the items original warranty period noted in Paragraph II.
- F** All freight charges will be paid for by the Purchaser.

PROPRIETARY RIGHTS STATEMENT

The design information contained herein is the sole property of Systron Donner. The disclosure of this information does not constitute the release of proprietary rights thereof, but is to be used for informational purposes only. Permission to reproduce this information of the product described herein must be obtained in writing from Systron Donner.

LIST OF EFFECTIVE PAGES

(Revision/Configuration Control Document)

The P6/P12 Programmers Power Supply Operating and Service Manual is a revision/configuration-controlled document. Original pages are date coded 10-83; pages changed in the future will be indicated according to respective revision date(s).

Total Number Of Pages In This Publication Is 93, Consisting Of The Following:

Page No.	Issue Date	Page No.	Issue Date
Title	1982	6-1 - 6-3/6-4 blank)	12-83
Warranty	1985	6-5	4-84
Proprietary Rights Statement	1982	6-6	2-84
Statement	1982	6-7	6-84
List of Effective Pages - A	6-85	6-8	6-84
Table of Contents i - ii	6-84	6-9 - 6-11	2-84
Safety Practices iii - iv	12-83	6-12	4-84
Safety Practices v/(vi blank)	6-84	6-13	7-84
1-1	12-83	6-14 - 6-15	2-84
1-2	9-84	6-16	6-84
1-3 - 1-5/(1-6 blank)	12-83	6-17	7-84
2-1 - 2-2	6-84	6-18	6-84
2-3/(2-4 blank)	12-83	6-19	2-84
3-1 - 3-2	12-83	6-20 - 6-22	12-83
3-3 - 3-5/(3-6 blank)	6-84	6-23 - 6-32	6-84
4-1 - 4-2	6-84	7-1	6 84
4-3 - 4-4	12-83	7-2	7-84
4-5	6-84	7-3 - 7-9/(7-10 blank)	2-84
4-6	12-83	7-11/(7-12 blank)	7-84
4-7	6-84	7-13	2-84
4-8 - 4-12	12-83	7-14	12-83
4-13 - 4-19/(4-20 blank)	6-84	7-15 - 7-16	7-84
5-1 - 5-4	6-84	7-17 - 7-21/(7-22 blank)	6-84

TABLE OF CONTENTS

CHAPTER	PAGE	CHAPTER	PAGE
1 - GENERAL INFORMATION		5 - MAINTENANCE (Cont'd)	
1-1 Introduction	1-1	5-7 Interior Cleaning	5-1
1-4 Manual Effectivity	1-1	5-9 Exterior Cleaning	5-1
1-6 Description	1-1	5-11 Lubrication	5-1
1-8 Specifications	1-1	5-13 Visual Inspection	5-1
1-10 Outline Drawings	1-3	5-16 Calibration	5-2
1-12 Safety Practices	1-3	5-18 Equipment Required	5-2
2 - INSTALLATION		5-20 DAC-4 Calibration Proce- dure	5-2
2-1 Introduction	2-1	5-21 DAC-400 Series Calibration Procedure	5-3
2-3 Receiving Inspection	2-1	5-22 Performance Test	5-4
2-6 Installation and System Integration	2-1	6 - REPLACEABLE PARTS	
2-8 Installation	2-1	6-1 Introduction	6-1
2-12 Power Requirements and Connections	2-1	6-3 Part Ordering Information	6-1
2-15 GPIB Interface Connection	2-2	6-6 Parts Lists	6-1
2-17 DFI Interface Connection	2-2	Shipping Assembly	6-5
2-19 System Intraconnects	2-2	Top Cover Assembly	6-6
2-21 Preparation for Reshipment	2-2	Test Assembly	6-7
3 - OPERATION		Front Panel Assembly	6-9
3-1 Introduction	3-1	Support Bracket Assembly	6-10
3-4 Initialization Procedures	3-1	Support Bracket Assembly	6-11
3-6 Address Assignment Procedures	3-1	Transformer Cable Assembly	6-12
3-8 Application of Line Power	3-2	A1, +5 V Power Supply Assembly	6-13
3-10 Rear Panel Functions	3-2	A1A1, +5 V PC Assembly	6-14
4 - PRINCIPLES OF OPERATION		A2, Bus PC Assembly	6-15
4-1 Introduction	4-1	A2A0, Interface PC Assembly	6-16
4-5 Overall Functional Description	4-1	A2A1 through A2A7 DAC-4 PC Assembly	6-19
4-11 Interface PCB Assembly	4-2	A1-A7 DAC-4XX Parent PCB Assembly	6-23
4-23 DAC-4 PCB Assembly	4-6	DAC-401 Assembly	6-27
4-42 DAC-400 Series PCB Assemblies	4-13	A1A1, DAC-401 12-Bit PC Assembly	6-28
5 - MAINTENANCE		DAC-402 Assembly	6-29
5-1 Introduction	5-1	A1A2, DAC-402 16-Bit PC Assembly	6-30
5-3 Preventive Maintenance	5-1	Ribbon Cable Assembly	6-31
5-5 Cleaning	5-1	Option T2 Transformer Cable Assembly	6-32
		7 - DRAWINGS	
		7-1 Introduction	7-1

TABLE OF CONTENTS (Cont'd)

LIST OF TABLES

TABLE		PAGE
1-1	P6/P12 Programmers Specifications	1-2
3-1	Talk/Listen Address vs ASCII Character	3-1
3-2	P6, Rear Panel Functions .	3-3
3-3	P12, Rear Panel Functions .	3-3
3-4	DAC-4/Power Supply Interface Connector Pin Designations.	3-4
4-1	AD567 Truth Table	4-11
4-2	DAC-400 Series Configuration	4-13
6-1	Manufacturer's Code-To-Name Index	6-2
7-1	List of Drawings	7-1

LIST OF FIGURES

FIGURE		PAGE
1-1	P6, Programmer Outline Drawing	1-4
1-2	P12, Programmer Outline Drawing	1-5
2-1	Power Supply System 1001-S7554	2-3
3-1	P6, Programmer Rear Panel .	3-2
3-2	P12, Programmer Rear Panel.	3-4
4-1	P6/P12 Programmer Functional Block Diagram	4-3
4-2	Interface PCB Assembly Functional Block Diagram	4-4
4-3	MC68488 GPIB Interface Adapter Block Diagram . . .	4-5
4-4	MC6802 MPU Block Diagram .	4-6
4-5	MC6821 PIA Block Diagram .	4-7
4-6	DAC-4 Functional Diagram .	4-9
4-7	AD567 Functional Block Diagram	4-11
4-8	DAC-08 Functional Block Diagram	4-12
4-9	DAC-400 Series Parent Assembly Functional Diagram . .	4-15
4-10	V _{LI} M DAC Functional Block Diagram	4-17

LIST OF FIGURES (Cont'd)

FIGURE		PAGE
4-11	16-Bit DAC Subassembly Functional Diagram	4-19
4-12	12-Bit DAC Subassembly Functional Diagram	4-19
7-1	Shipping Assembly 06580301.	7-2
7-2	Top Cover Assembly 06597601	7-3
7-3	Front Panel Assembly 06581601	7-4
7-4	PCB Support Bracket Assembly 06582101	7-5
7-5	PCB Support Bracket Assembly 06582201	7-6
7-6	P6, Bus Board PC Assembly 06579601	7-7
7-7	+5V Power Supply Assembly 06924502	7-8
7-8	+5V Power Supply PC Assembly 06917802	7-9
7-9	+5V Power Supply Schematic 06918002	7-9
7-10	P6, Test Assembly 06576901.	7-11
7-11	P6, Schematic 06576801 . .	7-13
7-12	DAC-4 PC Assembly 06576501.	7-14
7-13	DAC-4 PC Assembly Schematic 06576401	7-15
7-14	Interface PC Assembly 06577501	7-16
7-15	Interface PC Assembly Schematic 06577601	7-17
7-16	DAC-4XX Parent PCB Assembly 07902601	7-18
7-17	DAC-401 Assembly 07903701 .	7-18
7-18	DAC-402 Assembly 07903702 .	7-18
7-19	DAC-400 Series Schematic 07902601	7-19
7-20	DAC-400 Series 12-Bit PC Assembly 07902801	7-20
7-21	DAC-400 Series 12-Bit Schematic 07902801	7-20
7-22	DAC-400 Series 16-Bit PC Assembly 07902901	7-21
7-23	DAC-400 Series 16-Bit Schematic 07902901	7-21

P6/P12 PROGRAMMERS

SAFETY PRACTICES

Personnel assigned to the operation or maintenance of the P6/P12 Programmers are encouraged to review the safety practices given in this section. These are recommended procedures which may prevent a serious accident, save a life, or protect the instrument from damage.

Whenever the safety of operating or maintenance personnel is involved, special safety instructions are inserted in the text as "WARNINGS". Instructions concerning the safety of equipment are inserted as "CAUTIONS". These notations are discussed in greater detail at the end of this section.

The following recommended procedures should be understood and applied during any phase of operation or maintenance of this equipment:

CHASSIS GROUNDING

Prior to applying power to the unit, determine that the internal protective power ground is connected to the protective ground conductor of the power cord. This ground, in turn, must be connected through the external power cord to the grounded power outlet. (Verify ground continuity using an ohmmeter, with power totally removed from the instrument.)

a. Any interruption of the protective ground conductor, inside or outside of the P6/P12 could create a potentially hazardous condition due to possible (chassis) voltage differences between this and other equipments. When connected into a system with other units, all power grounds should connect through a common bus to optimize circuit breaker response in the event of electrical failure. Intentional interruption of the grounding system by the use of two-wire plug adapters or two-wire extension cords must be considered an unsafe practice.

b. Whenever it is determined that the protective ground system has been impaired, the equipment must be made inoperative or be secured against inadvertent operation until the deficiency is corrected.

KEEP AWAY FROM LIVE CIRCUITS

Operating and maintenance personnel are cautioned against using the programmer with cover panels removed and power applied, unless directed to do so by a specific instruction manual procedure (troubleshooting, calibration, etc).

a. Under certain conditions, dangerous potentials may still exist when power is removed from the instrument due to charges retained by capacitors. To avoid injury, always remove power; then, discharge or ground any large capacitors prior to replacing components or making repairs.

b. To avoid potential damage to the programmer, always remove power from the instrument before extracting or inserting any circuit boards and/or discrete components.

c. Troubleshooting, repair, or adjustments of the programmer with power applied to the circuits should be minimized whenever possible. However, when instruction manual procedures so dictate, these should be performed only by skilled technical persons who are aware of the various hazards involved.

DO NOT SERVICE OR ADJUST ALONE

Under no circumstance should any person service or adjust equipment unless in the presence of another person who is capable of rendering first aid/resuscitation services in the event of an accident.

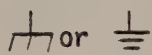
DEFECTIVE PARTS REPLACEMENT

CAUTION

To avoid possible damage or degrading of instrument performance, technical personnel are cautioned to replace defective components only with new factory replacement items; or, in certain cases, cross-referenced, direct-substitute items. Be certain that only the correct power fuse with required rating (voltage/current) and specified type (fast blow, slow blow, etc) is used for replacement purposes. The use of repaired fuses or short circuiting of the fuseholder is considered an unsafe practice.

SAFETY SUMMARY

The following safety and special symbols are used on the P6/P12 Programmer and/or in this manual.

 or  Indicates earth (ground) terminal

 Indicates digital ground

 Indicates analog ground

WARNING

The **WARNING** sign denotes a personnel hazard. It calls attention to a procedure or practice, which, if not correctly performed or adhered to, could result in personal injury. Do not proceed beyond a **WARNING** sign until the indicated conditions are fully understood and met.

The **CAUTION** sign denotes an instrument hazard. It calls attention to an operating procedure or practice, which, if not correctly performed or adhered to, could result in damage to, or destruction of part of all of the instrument. Do not proceed beyond a **CAUTION** sign until the indicated conditions are fully understood and met.

Warning and Cautions appearing in the text of this instruction manual are repeated here for review and emphasis by personnel operating or maintaining this instrument.

WARNING

Before applying power, to the Programmer, ensure that the protective ground terminal of the module is connected to the protective conductor of the (mains) power cord. The power cord plug shall only be inserted into an output provided with protective ground contact. The protective conductor must not be negated by the use of an extension cord without a protective grounding conductor.

WARNING

All analog circuitry is isolated from digital ground (Δ) by optical isolators located on the DAC Assemblies, the HRP and HFP Series Power Supplies and the P6/P12 transformers T1 and T2. Analog ground (∇) is referenced to the + V (common) of the Power Supply in the associated DAC Assemblies and will float at the Power Supplies programmed output potential. Thus, the voltage differential of the analog and digital ground will be that of the programmed output of the associated Power Supply. When making measurements or adjustments on the DAC Assemblies, caution must be exercised to prevent electrical shock.

Page 4-1

CAUTION

To prevent compromise of the digital/analog isolation, observe caution when using a grounded oscilloscope or DMM. Failure to do so could result in damage to the Programmer.

Page 4-2

WARNING

The analog ground (∇) is referenced to the + V (common) of the associated Power Supply and thus will float at the associated Power Supplies programmed output potential when interfaced into the system. Caution must be exercised to prevent electrical shock.

Page 4-7

CAUTION

Analog ground (∇) and digital ground (Δ) are isolated by optical isolators and the analog power supply transformer on the P6/P12 chassis, observe caution when using grounded test equipment so not to compromise the digital/analog isolation. Failure to do so could result in damage to the DAC Assembly and/or its associated Power Supply.

Page 4-7

CAUTION

Certain components within the Programmer can be damaged by use of carbon-based solvents. Avoid use of chemicals that contain acetone, benzene, toluene, xylene, petroleum, ether, kerosene, carbon tetrachloride, methylene chloride and trichlorotrifluoroethane (i.e., freon 113, -tf-ta-me). Recommended agents for interior cleaning are isopropyl alcohol or kelite (1 part kelite to 30 parts water). It is safe to use ethyl alcohol and methyl alcohol if the recommended solvents are not available.

Page 5-1

CHAPTER 1

GENERAL INFORMATION

1-1. INTRODUCTION

1-2. This operating and service manual contains information relating to the installation, operation, maintenance, and calibration of the Systron Donner P6/P12 Programmers.

1-3. The information contained in this manual is divided into front matter and seven descriptive chapters, indicated in the following format.

Front Matter: includes the title page, warranty policy, proprietary rights statement, list of effective pages, table of contents, list of figures, list of tables, and safety practices information.

Chapter 1 - General Information: contains a general description of the P6/P12 Programmers, and safety practices.

Chapter 2 - Installation: describes unpacking and receiving inspection, installation criteria, initial turn-on/system interconnection, and preparation for reshipment.

Chapter 3 - Operation: provides descriptions of program statements for the language translation and fault isolation capabilities of the Programmers as related to the programmable power supply system.

Chapter 4 - Principles of Operation: contains a detailed functional/circuit analysis of the P6/P12 Programmers, which will assist technical personnel in the performance of troubleshooting and/or calibration procedures.

Chapter 5 - Maintenance: describes the steps required for routine maintenance, inspection, alignment, and performance verifications.

Chapter 6 - Replaceable Parts List: provides a listing of all replaceable parts, along with parts ordering information, and manufacturer's code-to-name index.

Chapter 7 - Drawings: provides technical personnel with requisite schematic and component location diagrams for maintenance and troubleshooting of the P6/P12 Programmers.

1-4. MANUAL EFFECTIVITY

1-5. Information contained in this operating and service manual is date-coded at the bottom of each page. A summary of these date codes is given in the List of Effective Pages (A page) located within the front matter of this manual. Any future changes to this manual will be reflected in the List of Effective Pages.

1-6. DESCRIPTION

1-7. The P6/P12 is a family of digital power supply programmers that provides the programming of the Systron Donner HRP and HFP series programmable power supplies. The P6 Programmer is a half rack seven channel module which can control and program up to seven individual power supplies. The P12 Programmer is a full rack thirteen channel module which can control and program up to thirteen individual power supplies.

1-8. SPECIFICATIONS

1-9. Table 1-1 lists the specifications applicable to the P6/P12 Programmers.

Table 1-1. P6/P12 Programmers Specifications

Control Interface:	IEEE Std-488 1978 "IEEE Standard Digital Interface for Programmable Instrumentation". (Common name: "General Purpose Interface Bus" [GPIB]).	
Interface Language:	"Mate Control Interface Intermediate Language" (CIIL) Specifications for use with Modular Automatic Test Equipment Systems 2806763 Rev B.	
Analog Outputs:	0 to 10 Vdc 5 mA maximum at 10 V	
Resolution:	Voltage: 12 or 16-Bits Current: 12 or 16-Bits V _{LIM} 8-Bits	
Step Response to Program Change:	1 ms	
Dimensions:	P6	P12
	Height: 13.25 cm (5.22 in)	13.25 cm (5.22 in)
	Width: 21.27 cm (8.375 in)	42.54 cm (16.750 in)
	Depth: 44.37 cm (17.470 in)	44.37 cm (17.470 in)
	Front Panel	
	Handle Projection: 3.81 cm (1.50 in)	
Weight: (without DAC PCB Assemblies)	3.4 kg (7.5 lbs)	3.6 kg (8 lbs)
Weight: (Each DAC PCB Assembly)	0.408 kg (0.9 lbs)	
Power Requirements:	Line Voltage: 115/230 Vac $\pm 10\%$ Line Frequency: 47 to 440 Hz	
Load: (Without DAC PCB Assemblies)	10 W	
Each DAC PCB Assemblies:	1.5 W	
Temperature:	Storage: -40° to +85°C (-40°F to +185°F) Operating: 0°C to +55°C (32°F to +131°F)	

1-10. OUTLINE DRAWINGS

1-11. Outline drawings with dimensional data for the P6 and P12 Programmers are provided by figures 1-1 and 1-2 respectively.

1-12. SAFETY PRACTICES

1-13. Prior to operation or maintenance of the P6/P12 Programmer, technical personnel are encouraged to review safety practices section located in the front matter of this manual. Removal of the covers while the Programmer is operating, exposes personnel to possible contact with dangerous potentials. Only allow qualified personnel to maintain this instrument.

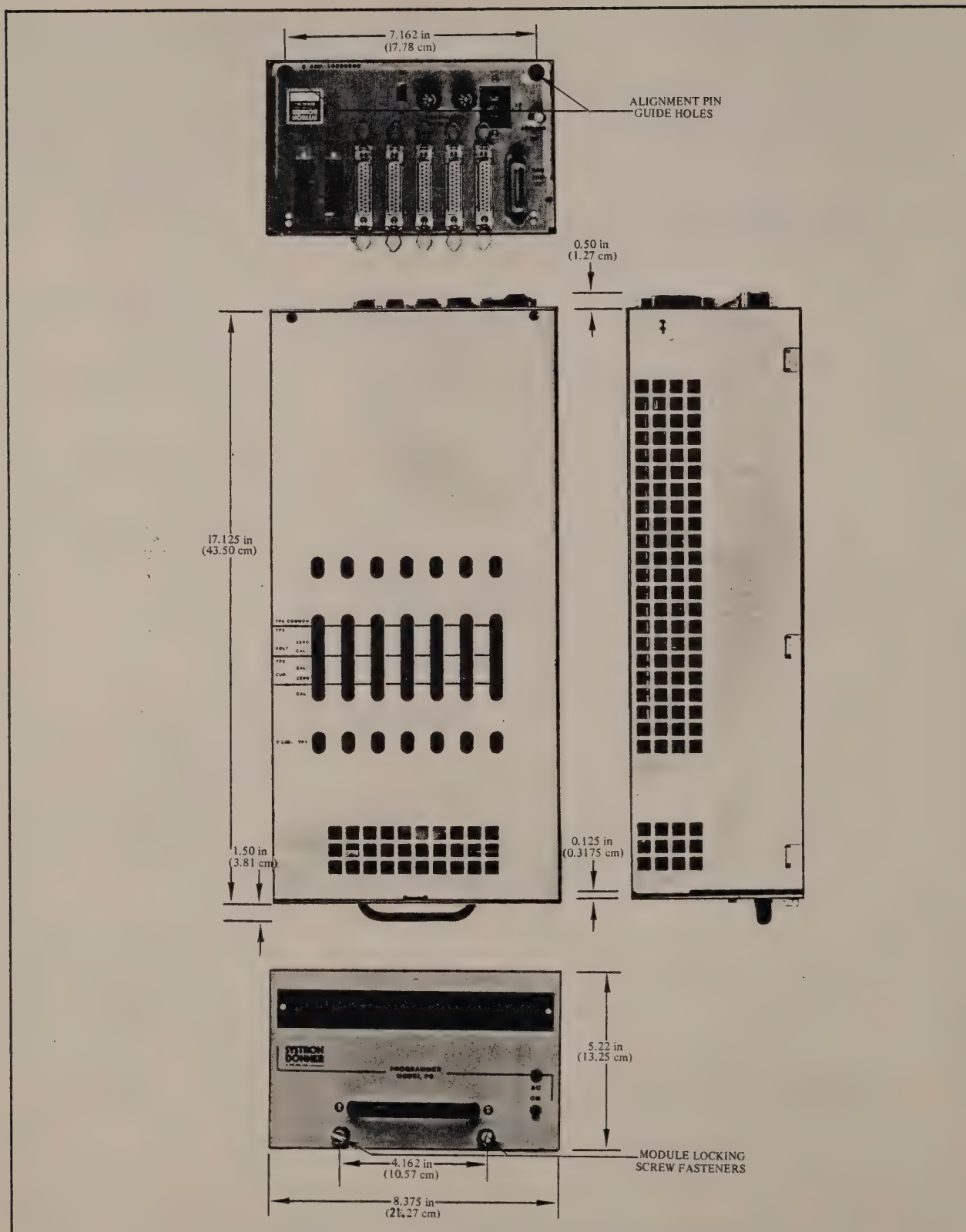


Figure 1-1. P6 Programmer Outline Drawing

To Be Supplied

Figure 1-2. P12 Programmer Outline Drawing

CHAPTER 2

INSTALLATION

2-1. INTRODUCTION

2-2. This chapter outlines the procedures for initial inspection and installation of the P6/P12 Programmers. The subject matter includes receiving inspection, installation criteria and the integration of the Programmer into a Power Supply System. Instruction concerning preparation for reshipment are included at the end of this chapter.

2-3. RECEIVING INSPECTION

2-4. Prior to accepting the Programmer from the shipper, inspect the condition of the shipping container for any indication of freight damage. Any sign of such damage must be noted by both the shipper and receiver and should be reported to the insurance investigator.

2-5. Immediately following removal of the Programmer from the shipping carton, inspect for possible physical damage incurred during shipment. Check external surfaces for scratches or dents and note the condition of all connectors, circuit breakers, etc. that protrude from the front and rear panels of the rack assemblies. Should any damage be detected, notify your nearest Systron Donner representative - DO NOT USE THE INSTRUMENT UNTIL INSTRUCTED TO DO SO BY THE REPRESENTATIVE.

2-6. INSTALLATION AND SYSTEM INTEGRATION

2-7. The P6/P12 Programmers can be installed in a number of different system configurations. The P6 Programmer module is a half rack assembly which accommodates one to seven DAC cards. The P12 Programmer module a full rack assembly, that will expand the system potential up to thirteen DAC cards, thus allowing up to thirteen Power Supplies to be integrated into one system.

2-8. Installation

2-9. The Programmer is provided with front panel captive fasteners and rear panel alignment guides, allowing for its installation into a Systron Donner RA4 Rack Mount Assembly. The RA4 Rack Mount Assembly also accepts the HRP and HFP Series Power Supply modules, thus providing system integration into standard 19-inch rack assemblies.

2-10. Figure 2-1 provides an example of a power supply system installed in to three rack mount assemblies. The system is depicted in the System 1001-S7554, and consists of a P6 Programmer module, two HRP36-10 Power Supply modules, two HRP60-7 Power Supply modules and a HFP500-1 Power Supply module.

2-11. Refer to the appropriate systems manual for detailed installation instructions concerning programmer integration - within a specific system.

2-12. Power Requirements and Connections

2-13. The P6/P12 modules are supplied with a heavy duty 3 conductor detachable line cord with molded NEMA type 5-15P plug, which mates with the rear panel IEC type connector J1.

WARNING

Before applying power to the Programmer, ensure that the protective ground terminal of the module are connected to the protective conductor of the (mains) power cord. The power cord plug shall only be inserted into an output provided with protective ground contact. The protective conductor must not be negated by the use of extension cord without a protective grounding conductor.

2-14. The Programmer is capable of operation on either 115 or 230 Vac single phase $\pm 10\%$ 47 to 440 Hz. The Programmer is shipped from the factory normally wired for 115 volts unless it was ordered with a 230 volt system. To convert to 230 volt operation reconfigure wiring on terminal boards TB1 and TB2 by removing jumpers from pins 5 to 7 and add jumper from pins 7 to 7. The rear panel 3/4 A line fuse must be replaced with a 3/8 A fuse to provide proper protection. Refer to P6/P12 schematic diagram 06576801 located in chapter 7 of this manual for wiring details.

2-15. GPIB Interface Connection

2-16. An IEEE Std-488 metric dimensioned 24-pin connector is provided on the rear panel of the P6/P12 Programmer modules marked "J2 IEEE BUS" to provide GPIB interface with the system and a controller device. Refer to IEEE Std-488 1978 for functional, electrical and mechanical specifications of this interface.

2-17. DFI Interface Connection

2-18. A 2-pin Amphenol 31-2225 connector is provided as an option at the P6/P12 rear panel. Marked "J3 DFI OUT", it provides a systems discrete fault indication (DFI), as a relay closure in the event any discrete faults are generated by the system. Refer to the appropriate systems manual for details. The required mating connector (not supplied) is Amphenol 31-2226 or equivalent.

2-19. System Intraconnection

2-20. Up to thirteen 25-pin connectors (J101 through J113) may be installed on a as required basis, on the P6/P12 Programmers rear panel. These connectors marked "CH1" through "CH13" provides for the dc analog control signals for the power supplies and their status reporting. The programmer-to-power supply interconnect cables may be up to 20 feet in length without any degradation in system performance. Refer to the appro-

prate systems manual for installation details of these system supplied cables.

2-21. PREPARATION FOR RESHIPMENT

2-22. When a P6 or P12 Programmer is repackaged for shipment, use original packing materials or package in accordance with MIL-P-116 and MIL-3-17555E specifications. Repackage the instrument using the following step procedures:

1. Attach an identification tag to the Programmer indicating model number, serial number, name and address of the owner and a summary of the service or repairs required.
2. Wrap the assemblies in sheets of heavy paper or plastic prior to placing it in the shipping container.
3. Select a strong carton or wooden box as a shipping container.
4. Use an adequate layer of shock absorbing material on all six sides of the unit. Protect the instrument front and rear panels with additional layers of cardboard. Ensure that no movement of the assembly is evident within the container.
5. Seal shipping container with strong tape or metal bands. Attach a packing list to the outside surface.
6. Mark shipping container "FRAGILE-DELICATE INSTRUMENT" and attach the appropriate handling symbols to ensure reasonable care in transit.
7. Be certain all correspondence relating to service or repair of the Programmer includes information contained on the system identification tag.

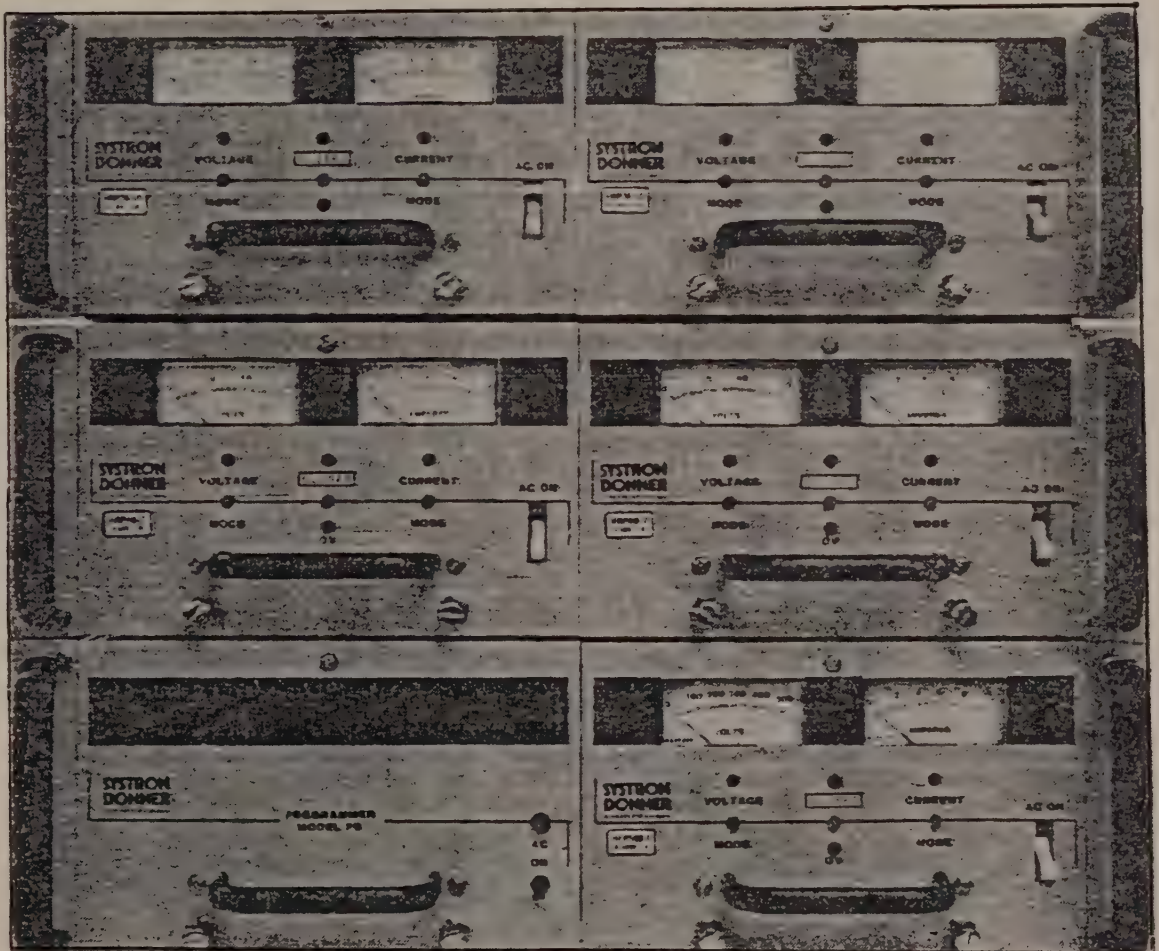
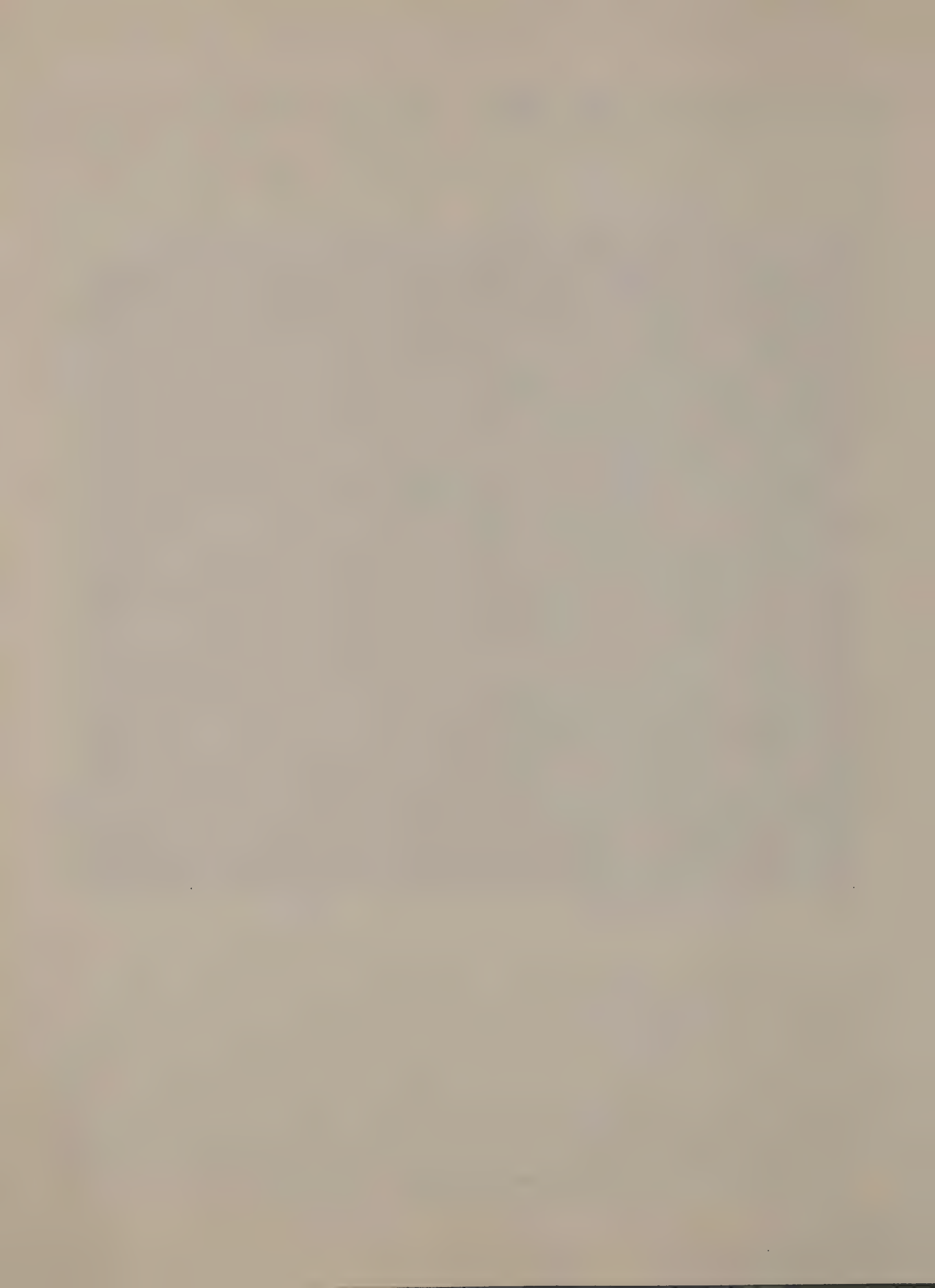


Figure 2-1. Power Supply System 1001-S7554



CHAPTER 3

OPERATION

3-1. INTRODUCTION

3-2. This chapter describes the operating procedures for the P6/P12 Programmers. A functional description of the switches and connectors that effect operation is also provided. The P6/P12 Programmers are operated using the General Purpose Interface Bus (GPIB). This interface permits the Programmer to provide control and status reporting of an automatic test equipment (ATE) power supply system.

3-3. Resident within the Programmers, programmable read only memory (PROM) is the firmware required for operation with a specific system. The language used is in accordance with a subset of Mate Control Interface Intermediate Language (CIIL). Refer to Systron Donners systems level operating and service manual for command entry procedures and status message generation.

3-4. INITIALIZATION PROCEDURE

3-5. To initialize the P6/P12 Programmer when installed within a system, requires GPIB address assignment and application of line power.

3-6. Address Assignment Procedures

3-7. Located on the A2A0 Interface PCB Assembly is a 5-digit switch S2 which provides for the setting of the programmers IEEE-488 device address. One of thirty-one talk and listen addresses may be assigned. Refer to table 3-1 for the address switch settings and the corresponding listen and talk ASCII characters.

Table 3-1. Talk/Listen Address vs ASCII Character

Address Switch Settings					ASCII Character	
5	4	3	2	1	Listen	Talk
0	0	0	0	0	SP	@
0	0	0	0	1	!	A
0	0	0	1	0	"	B
0	0	0	1	1	#	C
0	0	1	0	0	\$	D
0	0	1	0	1	%	E
0	0	1	1	0	&	F
0	0	1	1	1	'	G
0	1	0	0	0	(	H
0	1	0	0	1	)	I
0	1	0	1	0	*	J
0	1	0	1	1	+	K
0	1	1	0	0	,	L
0	1	1	0	1	-	M
0	1	1	1	0	.	N
0	1	1	1	1	/	O
1	0	0	0	0	0	P
1	0	0	0	1	1	Q
1	0	0	1	0	2	R
1	0	0	1	1	3	S
1	0	1	0	0	4	T
1	0	1	0	1	5	U
1	0	1	1	0	6	V
1	0	1	1	1	7	W
1	1	0	0	0	8	X
1	1	0	0	1	9	Y
1	1	0	1	0	:	Z
1	1	0	1	1	;	[
1	1	1	0	0	<	\
1	1	1	0	1	=	]
1	1	1	1	0	>	.
1*	1	1	1	1	?	-

*Not to be device assigned. Refer to note.

NOTE

A 11111 address must not be assigned to any unit interfacing the bus since this listen and talk address is reserved for the UNL (unlisten) ASCII (?) and the UNT (untalk) ASCII () command.

3-8. Application of Line Power

3-9. The P6/P12 Programmers are provided with a front panel power on/off toggle switch and LED power on indicator. To apply line power, set the toggle switch to the on (up) position and verify that the LED power indicator illuminates.

3-10. REAR PANEL FUNCTIONS

3-11. Figure 3-1 depicts the rear panel of the P6 Programmer providing indexing of each function. These functions are listed by index number and described in table 3-2.

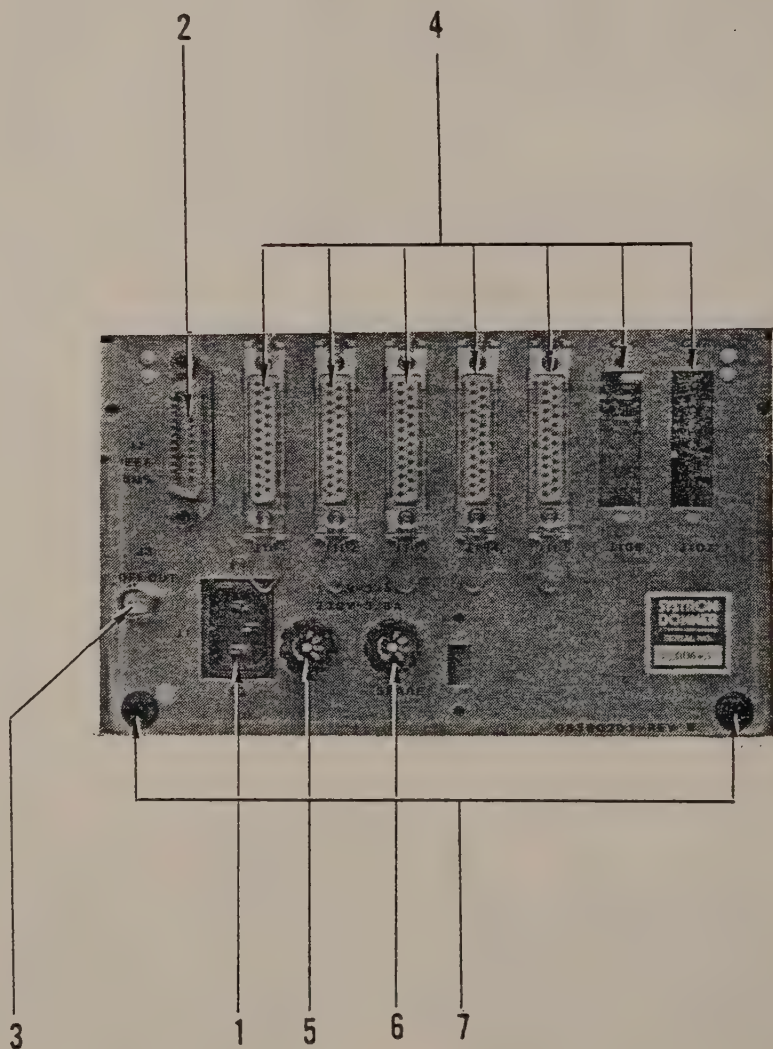


Figure 3-1. P6, Programmer Rear Panel

Table 3-2.
P6, Rear Panel Functions

Index	Name	Function
1	J1	An IEC type power receptical, provides for the connection of line power.
2	J2 IEEE	A 24-pin IEEE Std-488 metric dimensioned connector, provides GPIB interface with a controller device. Refer to IEEE Std-488 1978 for functional, electrical and mechanical specifications.
3	J3 DFI OUT	An Amphenol 31-2225 2-pin connector, provides a discrete fault indication (DFI) as a relay closer in the event any discrete faults are generated by the system firmware.
4	J101 through J107	Up to 7 25-pin connectors, provides for the interface between the DAC Assembly and its associated Power Supply module. Refer to table 3-4 for the pin designation of these connectors.
5		A fuse holder, contains an operational line fuse to provide overload protection. 3/4 A for 115 V operation or 3/8 A for 230 V operation.
6		A fuse holder, contains a spare line fuse. 3/4 A for 115 V operation or 3/8 A for 230 V operation.

Table 3-2.
P6, Rear Panel Functions (Cont'd)

Index	Name	Function
7		Two-alignment pin guide holes, provides the proper alignment of the P6 module when being inserted into the RA4 rack assembly.

3-12. Figure 3-2 depicts the rear panel of the P12 Programmer providing indexing of each function. These functions are listed by index number and are described in table 3.3.

Table 3-3.
P12, Rear Panel Functions

Index	Name	Function
1	J1	An IEC type power receptical, provides for the connection of line power.
2	J2 IEEE BUS	A 24-pin IEEE Std-488 metric dimensioned connector, provides GPIB interface with a controller device. Refer to IEEE Std-488 1978 for functional, electrical and mechanical specifications.
3	J3	An Amphenol 31-2225 2-pin connector, provides a discrete fault indication (DFI) as a relay closure in event any discrete faults are generated by the system firmware.
4	J101 through J113	Up to thirteen 25-pin connectors, provides for the interface be-

3-10. REAR PANEL FUNCTIONS

3-11. Figure 3-1 depicts the rear panel of the P6 Programmer providing indexing of each function. These functions are listed by index number and described in table 3-2.



Table 3-2.
P6, Rear Panel Functions

Index	Name	Function
1	J1	An IEC type power receptical, provides for the connection of line power.
2	J2 IEEE	A 24-pin IEEE Std-488 metric dimensioned connector, provides GPIB interface with a controller device. Refer to IEEE Std-488 1978 for functional, electrical and mechanical specifications.
3	J3 DFI OUT	An Amphenol 31-2225 2-pin connector, provides a discrete fault indication (DFI) as a relay closer in the event any discrete faults are generated by the system firmware.
4	J101 through J107	Up to 7 25-pin connectors, provides for the interface between the DAC Assembly and its associated Power Supply module. Refer to table 3-4 for the pin designation of these connectors.
5		A fuse holder, contains an operational line fuse to provide overload protection. 3/4 A for 115 V operation or 3/8 A for 230 V operation.
6		A fuse holder, contains a spare line fuse. 3/4 A for 115 V operation or 3/8 A for 230 V operation.

Table 3-2.
P6, Rear Panel Functions (Cont'd)

Index	Name	Function
7		Two-alignment pin guide holes, provides the proper alignment of the P6 module when being inserted into the RA4 rack assembly.

3-12. Figure 3-2 depicts the rear panel of the P12 Programmer providing indexing of each function. These functions are listed by index number and are described in table 3.3.

Table 3-3.
P12, Rear Panel Functions

Index	Name	Function
1	J1	An IEC type power receptical, provides for the connection of line power.
2	J2 IEEE BUS	A 24-pin IEEE Std-488 metric dimensioned connector, provides GPIB interface with a controller device. Refer to IEEE Std-488 1978 for functional, electrical and mechanical specifications.
3	J3	An Amphenol 31-2225 2-pin connector, provides a discrete fault indication (DFI) as a relay closure in event any discrete faults are generated by the system firmware.
4	J101 through J113	Up to thirteen 25-pin connectors, provides for the interface be-

To Be Supplied

Figure 3-2. P12, Programmer Rear Panel

Table 3-3.
P12, Rear Panel Functions (Cont'd)

Index	Name	Function
4	(Cont'd)	tween the DAC Assembly and its associated Power Supply module. Refer to table for the pin designations of these connectors.

3-13. Table 3-4 provides the pin designations for the 25-pin DAC Power Supply interface connectors. A number of pins are designated for functions that are currently not used by the P6/P12 Programmers and are so noted.

Table 3-4.
DAC/Power Supply Interface
Connector Pin Designations

Pin	Function
1 through 4	Signal Common (Referenced to +V of the Power Supply and analog reference ground () of the DAC Assembly.
5	+15 V Reference (not used)
6	Overvoltage (Crowbar) Reset.
7	+LED (not used)
8	-LED (not used)
9	(No connection)
10	Voltage Mode Flag
11	Current Mode Flag
12	Overvoltage Flag
13	(No connection)

Table 3-4.
DAC/Power Supply Interface
Connector Pin Designations (Cont'd)

Pin	Function
14	Voltage Control (0 to +10 V)
15	Normalized -V (0 to -10 V)
16	Current Control (0 to 10 V)
17	Current Control (0 to 1 V) (not used)
18	Voltage Limit (V_{LIM} Control (0 to +10 V)
19	Output Enable (+5 V)

Table 3-4.
DAC/Power Supply Interface
Connector Pin Designations (Cont'd)

Pin	Function
20	Close Output Relay (CLOSE Command)
21	Polarity Reverse (REV Command)
22	(No connection)
23	Flag Common (Reference to digital ground () of the DAC Assembly.
24	Over Temperature Flag
25	Output Relay Closed Flag

CHAPTER 4

PRINCIPLES OF OPERATION

4-1. INTRODUCTION

4-2. This chapter provides the principles of operation from two perspectives. An overview of the P6/P12 Programmers at the block diagram level and its relationship to a programmable power supply system is discussed first. Second a detailed circuit analysis of the different functional assemblies is presented and referenced to the schematic diagrams, located in chapter 7 of this manual.

4-3. The P6/P12 consists of a family of two digital Power Supply Programmers that provide for the programming of the HRP Series and the HFP500-1 programmable Power Supplies. The P6 Programmer is a half rack, seven channel module, which can control and program up to seven individual Power Supplies. The P12 Programmer is a full rack, thirteen channel module, which can control and program up to thirteen individual Power Supplies.

4-4. The two Programmers are virtually identical, the P12 being an extension allowing up to thirteen channels. The Programmers are system originated and are configured to a specific system which determines the number of channels supplied.

4-5. OVERALL FUNCTIONAL DESCRIPTION

4-6. Figure 4-1 provides a functional block diagram of the P6/P12 Programmers. Line power is applied to rear panel receptical J1 and routed to terminal boards TB1 and TB2 via on/off switch S1 and a 3/4 A line fuse F1. Terminal boards TB1 and TB2 provide for the fan out of ac power the A1, 5 V Logic Power Supply and transformers T1 and T2. The terminal boards also provide 115/230 V line voltage connection. The Programmer is shipped from the factory normally wired for 115 volts (as shown in figure 4-1), unless it was ordered with a 230

V system. To convert to 230 V operation, reconfigure wiring by removing jumpers from pins 5 to 7 on TB1 and TB2 and add a jumper from TB1 pin 7 to TB2 pin 7. The line fuse F1 must be changed from 3/4 A to 3/8 A rating to provide proper protection.

4-7. Assembly A1 is a 5 V 1 A power supply that provides +5 V V_{CC} to the digital logic contained on the pcb's plugged into the A2, Bus PCB Assembly. The +5 V is also applies to the front panel LED indicator DS1, providing a "pilot lamp" to indicate power on/off status.

4-8. Transformers T1 and T2 supply ac to the analog power supplies located on the individual DAC PCB Assemblies to provide isolation between the digital and analog power. Optical isolators located on the DAC PCB Assemblies and the HRP and HFP Series Power Supplies, provide the signal isolation between the analog and digital circuitry.

WARNING

All analog circuitry is isolated from digital ground (Δ) by optical isolators located on the DAC Assemblies, the HRP and HFP Series Power Supplies and the P6/P12 transformers T1 and T2. Analog ground (∇) is referenced to the + V (common) of the Power Supply in the associated DAC Assemblies and will float at the Power Supplies programmed output potential. Thus, the voltage differential of the analog and digital ground will be that of the programmed output of the associated Power Supply. When making measurements or adjustments on the DAC Assemblies, caution must be exercised to prevent electrical shock.

CAUTION

To prevent compromise of the digital/analog isolation, observe caution when using a grounded oscilloscope or DMM. Failure to do so could result in damage to the Programmer.

4-9. The A2 Bus PCB Assembly provides the bus interface between A2A0 Interface PCB and the DAC PCB Assemblies. AC power (36.5 V rms nominal) from the center taped secondaries of transformers T1 and T2 are distributed by the A2 Bus Assembly to the individual DAC Assemblies. When the extended option is configured, a single center tap secondary transformer referenced designated T2 for the extended P6 and T3 for the extended P12 is added to supply ac power to the A2A7, DAC Assembly (extended P6), and to the A2A13, DAC-400 Series Assembly (extended P12). The A2 Bus Assembly also provides +5 V digital V_{CC} and digital ground to all the plug-in PCB Assemblies A2A0 through A2A13.

4-10. Each installed DAC Assembly interfaces with its associated Power Supply module via 24-conductor flat ribbon cable connected between the DAC connector J2 and the associated rear panel connector.

4-11. INTERFACE PCB ASSEMBLY

4-12. The Interface PCB Assembly in the P6/P12 Programmer is referenced designated A2A0. The following description is referenced to figure 4-2 Interface PCB Functional Block Diagram and Figure 7-15 located in chapter 7 of this manual.

4-13. The Interface PCB Assembly is a MC6802 microprocessor based subsystem. The pcb contains one microprocessor (MPU) U2, 8 k bytes of programmable read only memory (PROM) U13, 1 k bytes of random access memory (RAM) U12, a GPIB peripheral interface adapter (GPIB PIA) U5, a peripheral interface adapter (PIA)

U3, an IEEE-488 transceiver U6 and U21, a 3-bit buffer driver U20, an 8-bit address driver U19 and a 4-bit data transceiver U18.

4-14. The GPIB-PIA U5 automatically handles the GPIB handshake protocol. Data is received or transmitted one byte at a time via the input or output buffer located on the chip. The GPIB "state" is determined by reading the chip's status register. The MPU treats the input and output buffers as memory, checking the status register to verify that the GPIB state is appropriate. The input and output of the chip is handled on a programmable interrupt basis by the subsystem firmware program to ensure the fastest response time for GPIB transactions. GPIB device address is assigned by the 5-bit GPIB address switch S2 via octal buffer U11 to the interface data bus. Interface to the GPIB is via IEEE-488 transceivers U6 and U21 and connector J1. Figure 4-3 provides a functional block diagram of the GPIB interface adapter U5.

4-15. The interface to the A2 bus via connector P1 is comprised of buffer driver U20, address driver U19 and U18 data transceiver. The DAC Assemblies A2A1 up to A2A13 are independently selected by address bits A4 through A7 which are hardwire coded on the individual DAC connectors via bus pins 9, K, 10 and L, or all can be selected by the S0 line from buffer U20. The MPU address data output is valid for 3 μ s. After data becomes valid, a 1 μ s strobe is generated by a dual one-shot multivibrator U17 which in effect is centered on the valid data output.

4-16. Figure 4-4 provides a functional block diagram of the MPU U2. Normally the MPU would run too fast to present an address and a data byte which requires 3 μ s. (This 3 μ s period is required for the DAC optoisolators to switch and stabilize). One-shot multivibrator U16 generates a 3 μ s "STRETCH" signal to reset flip-flop U1 which stretches the MPU data byte via its "MEMORY READY" (MR) input for the required 3 μ s period.

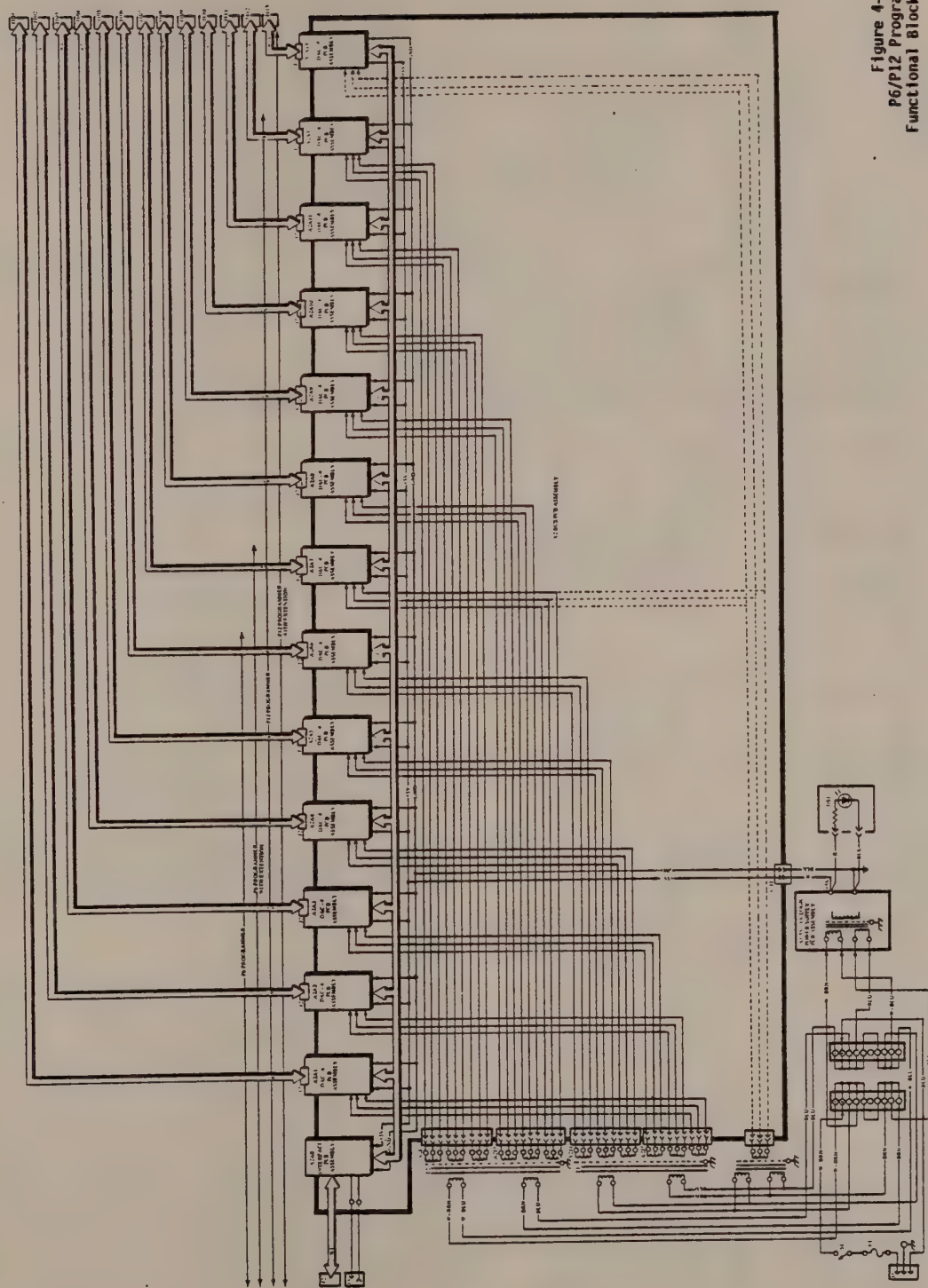


Figure 4-1.
P6/P12 Programmers
Functional Block Diagram



P6/P12-12-83

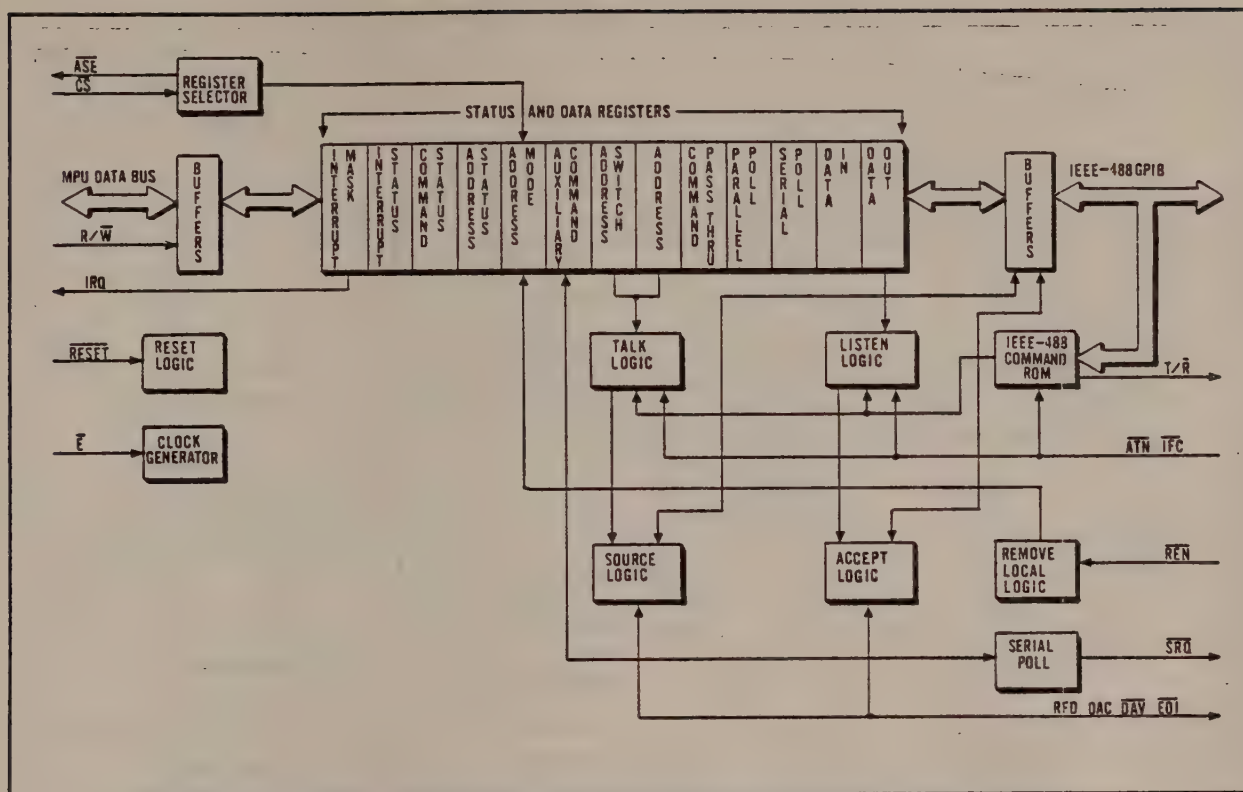


Figure 4-3. MC68488 GPIB Interface Adapter Block Diagram

4-17. Three elements of hex inverter U7 and 4 MHz crystal Y1 constitute a 4 MHz clock oscillator. This clock is divided by four within the MPU to generate the 1 MHz subsystem clock (ENABLE) $\bar{E}$ at U2 pin 37.

4-18. The power on reset timer U9 generates a 500 ms reset pulse, which is delayed 500 ms after power up is sensed by the application of +5 V V_{CC} . A 1 kHz free-running clock is generated by the timer U8, which is applied to the PIA U3 pin 40 CA1 input. The PIA processes this 1 kHz clock to generate the non-maskable interrupt (NMI) for output at its IRQA pin 38. The MPU non-maskable interrupt routine increments a register in its internal RAM, which is used as a real time clock to qualify any transitory detected power supply fault condition(s).

4-19. The PIA generates the discrete fault indicator (DFI) at its PBO output pin 10, which is applied to relay K1 via driver transistor Q1 to effect a relay contact closure. The DFI is used by the system as a service request, requesting immediate attention by the MATE controller device in the event of a potentially dangerous condition. Figure 4-5 provides a functional block diagram of the PIA U3:

4-20. The interface control subsystem program is structured so that when no other task is pending, the MPU will poll the associated systems Power Supplies (via the DAC pcb's) for status and fault flags. Whenever a fault condition is detected, an appropriate error message is assembled and loaded into a RAM location preparatory to transmission in response to a status request from the controller device.

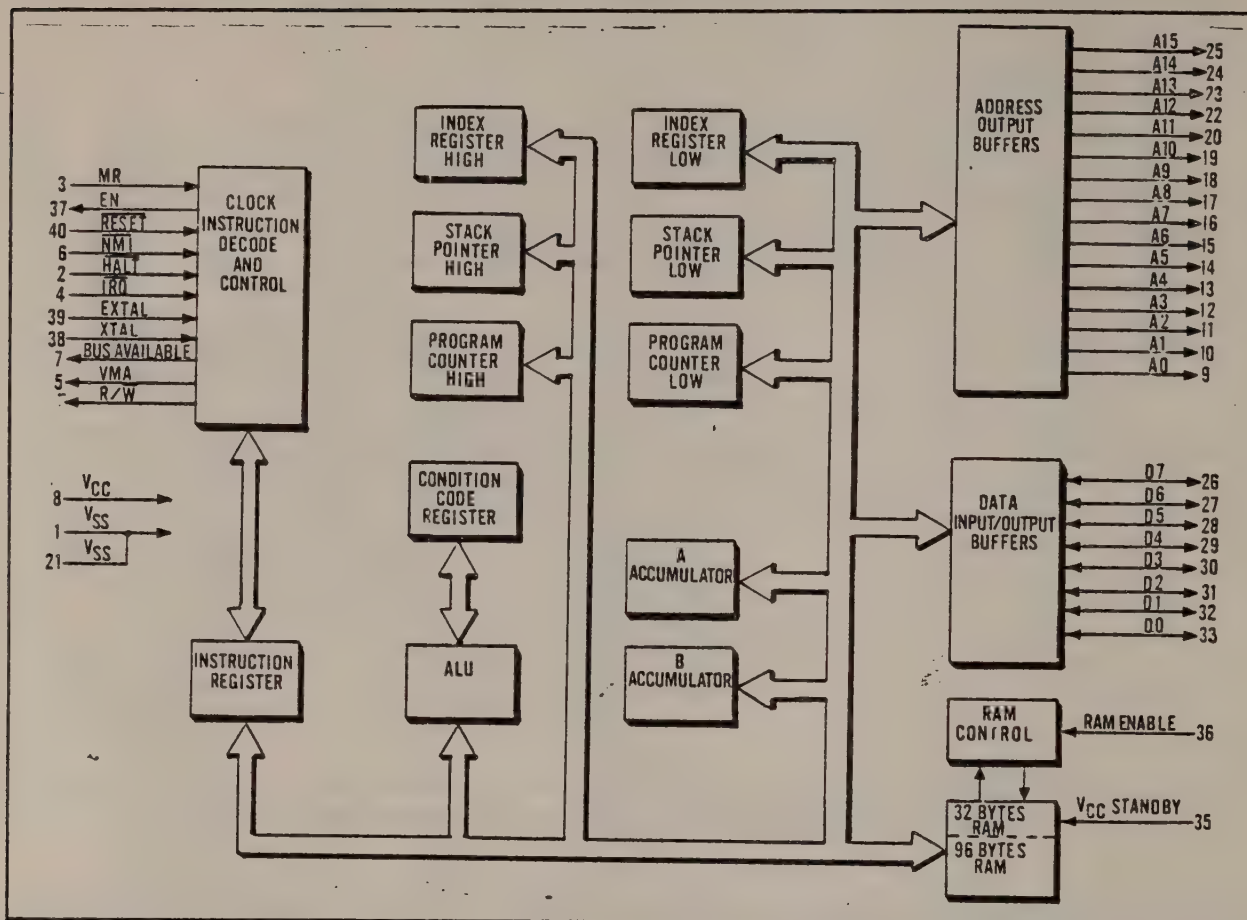


Figure 4-4. MC6802 MPU Block Diagram

4-21. A confidence routine (internal self test) has been incorporated into the firmware for the purpose of fault isolation. The messages generated from this confidence routine allows fault isolation to a line replaceable assembly of the associated power supply system.

4-22. The CIIL commands are interpreted by the firmware in accordance with "Mate System Control Interface Language" (CIIL) Specifications for use with Modular Automatic Test Equipment Systems 2806564.

4-23. DAC-4 PCB ASSEMBLY

4-24. The DAC-4 PCB Assembly converts digital control data from the Interface PCB Assembly A2A0 via the A2, Bus into analog programming signals for its associated power supply. The DAC-4 Assembly also monitors its associated power supply to determine the operating status and reports any status change to the Interface PCB Assembly A2A0 via the A2 Bus.

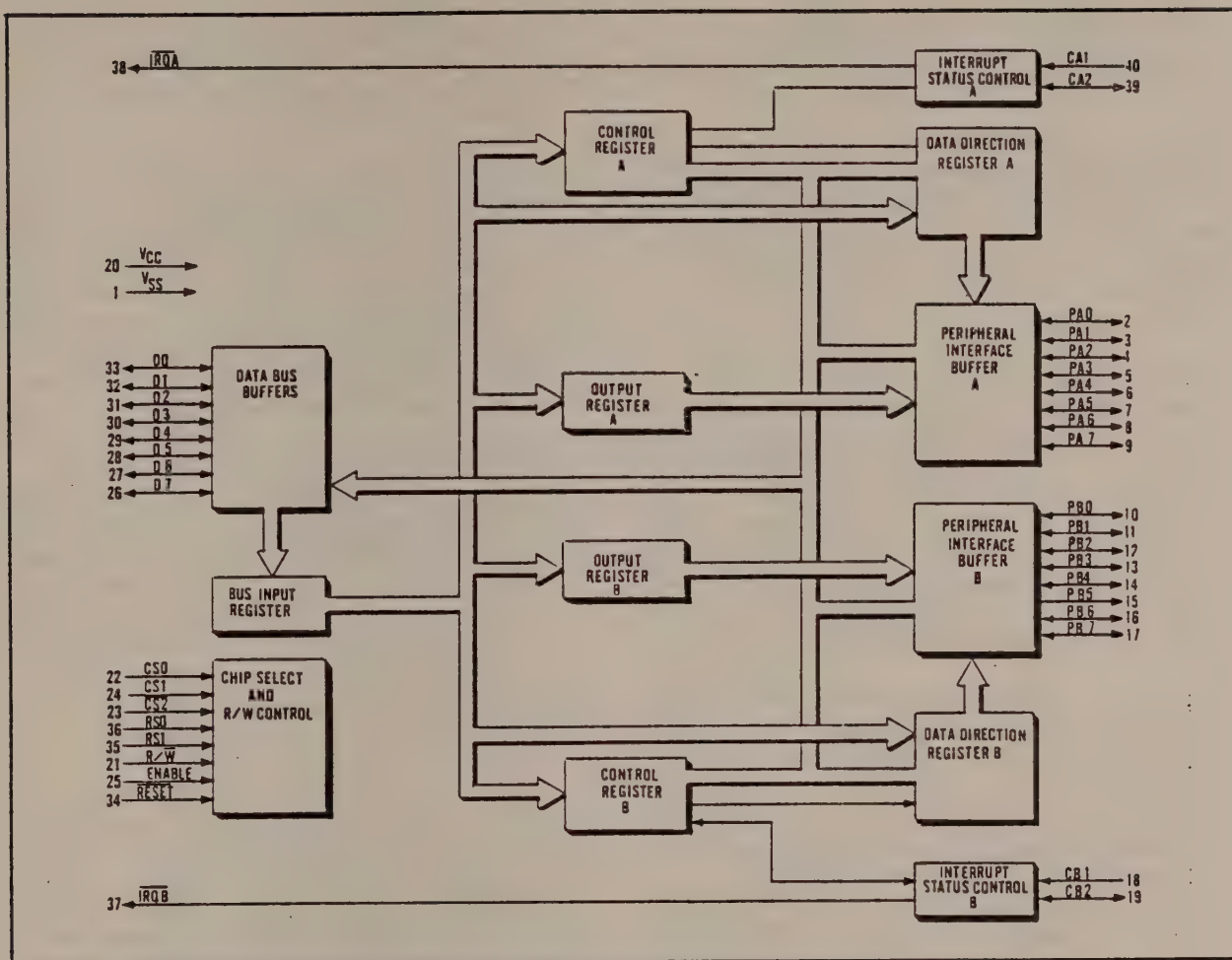


Figure 4-5. MC6821 PIA Block Diagram

4-25. The following description is referenced to figure 4-6 DAC-4 functional diagram and Figure 7-13 located in chap-7 of this manual.

WARNING

The analog ground (∇) is referenced to the + V (common) of the associated Power Supply and thus will float at the associated Power Supplies programmed output potential when interfaced into the system. Caution must be exercised to prevent electrical shock.

CAUTION

Analog ground (∇) and digital ground (Δ) are isolated by optical isolators and the analog power supply transformer on the P6/P12 chassis, observe caution when using grounded test equipment so not to compromise the digital/analog isolation. Failure to do so could result in damage to the DAC-4 Assembly and/or its associated power supply.

4-26. The A2 bus interfaces with the DAC-4 Assembly via edge connector P1. Connector J1 provides the interface to the associated power supply module.

4-27. The hex Schmitt trigger buffers U10, U29 and U30 provide the fifteen inputs from the A2 bus with noise immunity and logic inversion. The quad 2-input NAND gate U9 provides the output drive and logic inversion for the data bits D0 through D3.

4-28. Quad exclusive OR gate U28 provides for the selection of the individual power supply channel. The A2 bus address bits A4 through A7 are decoded by exclusive OR gating with the BCD S1, S2, S4 and S8 bits, which are hardwired coded on the A2 bus connector pins L, 10, K and 9 respectively. The S0 line will enable all power supply channels to write in simultaneously when set low.

4-29. The $R/\overline{W}$ line controls the talk and listen gating functions. When set high (write in) it enables the input gates (U20, U21 and U31-6) via OR gate U22-4 and inhibits the output data bit drivers U9 via NAND gate U31-3 and inverter U10-2. When set low (read out) enables the output drivers and inhibits the input gates. The input gates drive the nine input optical isolators comprised of U7, U18, U19, U26 and U27.

4-30. Five status flags from the associated power supply ($\overline{CM}$, $\overline{OT}$, $\overline{VM}$, $\overline{OV}$ and $\overline{CLSD}$) and three status flags from quad comparator U4 ($V>I$, $I>V_{LIM}$ and $\overline{UNREG}$) are applied to data multiplexer U8. Multiplexer U8 encodes the eight status flags into four data bits (D0 through D3). The data out of U8 is enabled by address bit A0 as a logic high on U8 pin 1. The data is applied to the quad output data bit driver U9.

4-31. The analog power supply consists of three IC voltage regulators U32, U33 and U34 which provide -15V, +15V and +5V referenced to analog ground respectively.

Bridge rectifier CR1 rectifies the 36 V ac center taped output of the transformer located on the P6/P12 chassis, thus providing the digital-to-analog dc electrical isolation.

4-32. Five dual optically coupled isolators (U7, U18, U19, U26 and U27) provide the digital-to-analog dc electrical isolation as well as immunity to common mode transients. Optical isolators U7 and U18 couple the four (D0 through D3) data bits via quad buffer inverter U17 to the voltage control dac (U14), the current control dac (U13) and the V_{LIM} control data storage registers (U11 and U12). Optical isolators U19 and U26 couple the four address bits (A0 through A3) to the two dual 1 of 4 mutually exclusive decoders (U24 and U16) via quad buffer inverter U25. Optical isolator U27B provides the coupling of the strobe (STB) to decoder U25B's enable (Eb) pin 15. Decoder U24A has its enable (Ea) pin 1 connected to analog ground, thus keeping it active at all times.

4-33. Decoder U24A generates the digital-to-analog converter (dac) four bit address at its a0 through a3 outputs, which is applied to the voltage control dac U14 and the current control dac U13. Decoder U24B generates the voltage dac enable at output b1 pin 11, the current dac enable at output b2 pin 10, the U16A decoder enable at output b3 pin 9 and the U16B decoder enable at output b0 pin 12.

4-34. Decoder U16A generates the enables for the V_{LIM} storage registers U11 and U12. Decoder U16A output d1 pin 5 provides the enable for the four LSD V_{LIM} storage register U11 and U16A output d0 pin 4 for the four MSD V_{LIM} storage register U12. Decoder U16B generates the discrete control functions. Decoder U16B output c0 pin 12 provides the crowbar reset function to one-shot multivibrator U23 as a logic low. The one-shot multivibrator generates a 10 ms duration pulse at its Q output at pin 4, which is

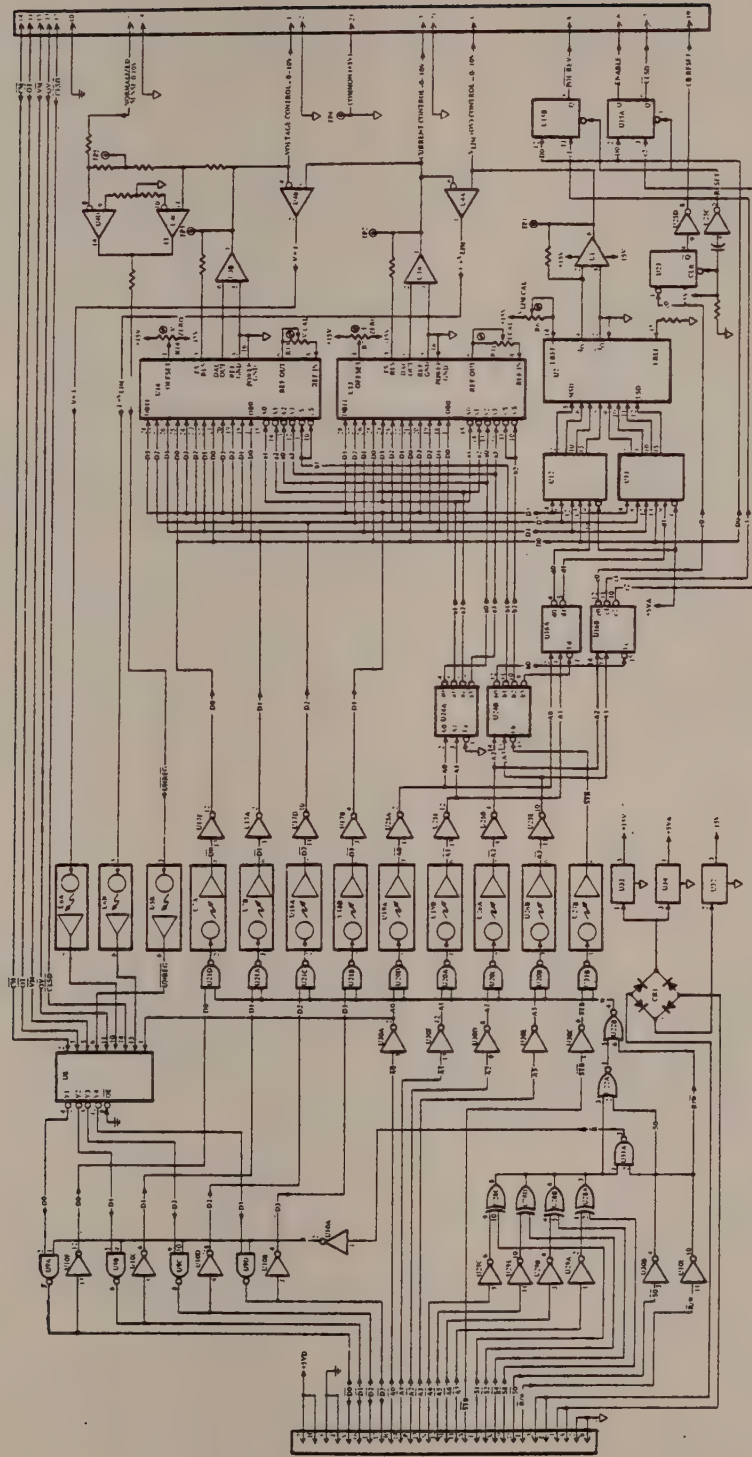


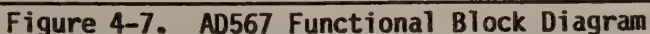
Figure 4-6.
DAC-4 Functional Diagram

4-35. The voltage dac U14 and the current dac U13 are 12-bit microprocessor compatible devices. They have their own internal 12-bit double buffered parallel latches which allows for the 4-bit data interface. These internal latches are controlled by the address inputs A0 through A3 and the CS inputs at pins 10 and 11. Pins 10 and 11 must be low for any operation to occur, thus function as chip selects. Table 4-1 provides a truth table of the dac latch selection.

CS	SR	A3	A2	A1	A0	Operation
1	X	X	X	X	X	No Operation
X	1	X	X	X	X	No Operation
0	0	1	1	1	0	Enable 4 LSBs of First Rank
0	0	1	1	0	1	Enable 4 middle Bits of First Rank
0	0	1	0	1	1	Enable 4 MSBs of First Rank
0	0	0	1	1	1	Loads Second Rank from First Rank
0	0	0	0	0	0	All Latches Transparent

"X" = Don't Care

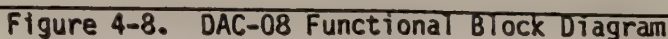
4-36. These dac's have internal Zener references which are laser-trimmed to 10.00 volts $\pm 1\%$ with a temperature coefficient of 10 ppm/ $^{\circ}\text{C}$ full scale. Fig-4-7 provides a functional block diagram of these 28-pin devices.



4-38. Current dac U13 REF OUT at pin 6 is adjusted by potentiometer R11 I CAL and applied back to the REF IN U13 pin 8. The current dac output U13 pin 2 is applied to operational amplifier U3A which outputs to 0 to 10 V CURRENT CONTROL signal to connector J1 pin 3. A 127 Ω resistor in series with the internal gain resistor at pin 3 FS RES to the operational amplifier output provides the dac with a nominal full scale of greater than 10 V. Potentiometer R7 I ZERO, zeros out any offset of the current control signal.

4-40. Operational amplifier U1 with its 5 k Ω feed back resistor R1 functions as a current-to-voltage converter and provides a 0 to 10 V V_{LIM} CONTROL signal to connector J1 pin 5. Potentiometer R6 V_{LIM} CAL provides full scale span adjustment.

4-41. Comparator U4A, provides level detection of the current control signal and the V_{LIM} control signal and outputs the $I > V_{LIM}$ status flag as a logic high to multiplexer U8 via optical isolator U6B. Comparator U4B, provides level detection of the current control signal and the voltage control signal to generate the $V > I$ status flag as a logic high to multiplexer U8 via optical isolator U6A. Comparators U4C and U4D provides a comparison of the normalized -sense 0-10V signal ($-V_N$) and the voltage control 0-10 V signal, if they are not equal, an UNREG status flag is generated and applied to multiplexer U8 via optical isolator U5B.



4-42. DAC-400 SERIES PCB ASSEMBLIES

4-43. The DAC-400 Series PCB Assemblies converts digital control data from the Interface PCB Assembly A2A0 via the A2 Bus into analog programming signals for its associated Power Supply. The DAC-400 Series Assemblies also monitors its associated Power Supply to determine the operating status and reports any status change to the Interface PCB Assembly A2A0 via the A2 Bus.

4-44. The DAC-400 Series PCB Assemblies consists of a Parent PCB Assembly part number 07902601 which contains an A1 Current DAC Subassembly and an A2 Voltage DAC Subassembly. These DAC Subassemblies may be either a 12-Bit DAC Subassembly part number 07902801 and/or a 16-Bit DAC Subassembly part number 07902901. Table 4-2 provides a listing of the different DAC-400 Series PCB Assemblies as to their DAC Subassembly loading configuration.

Table 4-2. DAC-400 Series Configuration

DAC Model Number	16-Bit Voltage DAC (A2)	16-Bit Current DAC (A1)	12-Bit Voltage DAC (A2)	12-Bit Current DAC (A1)
DAC-401			X	X
DAC-402	X			X
DAC-403	X	X		
DAC-404		X	X	

4-45. In the following circuit descriptions the circuit analysis of the Parent PCB Assembly is referenced to figure 4-9 DAC-400 Series functional diagram and schematic diagram 7-07902601 located in chapter 7 of this manual.

WARNING

The analog ground (∇) is referenced to the + V (common) of the associated Power Supply and thus will float at the associated Power Supplies programmed output potential when interfaced into the system. Caution must be exercised to prevent electrical shock.

CAUTION

Analog ground (∇) and digital ground (Δ) are isolated by optical isolators and the analog Power Supply transformer on the P6/P12 chassis, observe caution when using grounded test equipment so not to compromise the digital/analog isolation. Failure to do so could result in damage to the DAC-400 Series Assembly and/or its associated Power Supply

4-46. The A2 bus interfaces with the DAC-400 Series Assembly via edge connector P1. Connector J1 provides the interface to the associated Power Supply Module.

4-47. The hex Schmitt trigger buffers U24, U7 and U28 provide the 15 inputs from the A2 Bus with noise immunity and logic inversion. The quad 2-input NAND gate U25 provides the output drive and logic inversion for data bits D0 thru D3.

4-48. Quad exclusive OR gate U21 provides for the selection of the individual Power Supply channel. The A2 Bus address bits A4 through A7 are decoded by exclusive OR gating with the BCD S1, S2, S4 and S8 bits, which are hardwired coded on the A2 Bus connector pins L, 10, K and 9 respectively. The S0 line will enable all Power Supply channels to write in simultaneously when set low.

4-49. The R/W line controls the talk and listen gating functions. When set high (write in) it will enable the input gates (U26A,B,C and D, U23A,B,C and D and U30B) via OR gate U29B and inverter U28E and inhibit the output data bit drivers U25A,B,C and D via NAND gate U30A and inverter U28A. When set low (read out) it enables the output drivers and inhibits the input gates. The input gates drive the nine input optical isolators comprised of U16A, U16B, U17A, U17B, U18A, U18B, U19A, U19B and U20A.

4-50. Five status flags from the associated Power Supply (CM, OT VM and CLSD) and three status flags from quad comparators U8 (V>I, I>V_{LIM} and UNREG) are applied to data multiplexer U22. Multiplexer U22 encodes the eight status flags into four data bits (D0 through D2). The data output of U22 is enabled by address bit A0 as a logic high on U22 pin 1 (B SEL). The data is applied to quad output data bit driver U25.

4-51. The analog Power Supply consists of three IC voltage regulators U5, U6 and U7 which provide -15 V, +15 V and +5 V referenced to analog ground (▽) respectively. Bridge rectifier CR1 rectifies the 36 V rms center taped output of the transformer located on the P6/P12 chassis, thus providing the digital-to-analog dc electrical isolation.

4-52. Five dual optically coupled isolators (U16,U17,U18,U19 and U20) provide the digital-to-analog dc electrical isolation as well as immunity to common mode transients. Optical isolators U16 and U17 couple the four (D0 through D3) data bits via quad buffer inverter U12 to the voltage DAC Subassembly (A2), the current DAC Subassembly (A1) and the V_{LIM} control data storage registers (U3 and U4). Optical isolators U18 and U19 couple the four address bits (A0 through A3) to the sixteen line decoder U11 via quad buffer interter U13. Optical isolator U20A provides the coupling of the strobe (STB) to decoder U11's gate (G2) pin 19. U11's other gate (G1) pin 18 is connected to analog ground, thus keeping it active as all times.

4-53. The sixteen-line decoder U11 generates the addresses and enables for the dac devices and the discrete control flip-flops. A four-bit address at U11's a4 through a7 outputs are applied to the voltage DAC Subassembly A2. Four-bits a8 through a11 provide the address to the current DAC Subassembly A1. Bit a12 at U11 pin 14 is enable for the four MSD V_{LIM} storage register U3 and bit a13 at U11 pin 15 is the enable for the four LSD V_{LIM} storage register U4. U11's a0 output bit at pin 1 provides the discrete crowbar reset function to one-shot multivibrator U10. One-shot multivibrator U10 generates a 3 ms duration pulse at its Q output (pin 4), which is inverted by buffer inverter U13D to output a 3 ms CB RESET pulse at connector J1 pin 19. U11's a1 output at pin 2 provides the discrete polarity reversal function which is applied to D flip-flops U9B which in turn outputs the POL REV as a logic low at its Q to connector J1 pin 8.

4-54. The U11 a2 bit at pin 3 provides the power supply enable function which is applied to D flip-flop U9A. U9A outputs an ENABLE at its Q output pin 5 and a CLS at its Q output pin 6, which are applied to connector J1 pin 6 and 7 respectively.

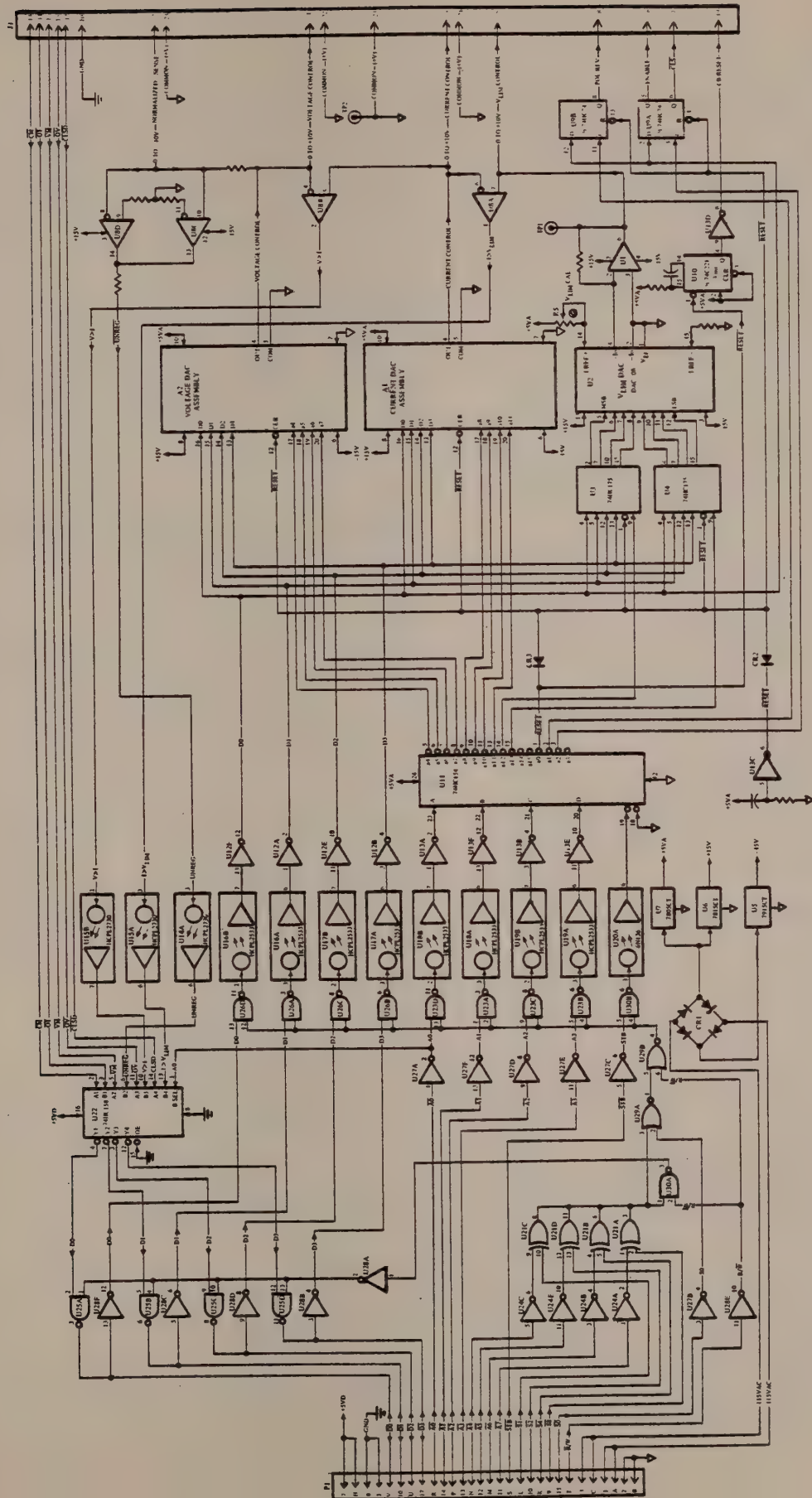


Figure 4-9
DAC-400 Series Parent PCB Assembly
Functional Diagram

4-55. Inverter U13C provides a power-on reset function which is coupled by diode CR2 to the RESET line. The CB RESET function generated by U11 bit a0 is also coupled to the RESET line by diode CR3. The RESET line is connected to the following devices: Current DAC Subassembly A1, Voltage DAC Subassembly A2, MSD V_{LIM} storage register U3, LDS V_{LIM} storage register U4, polarity reversal flip-flop U9B and Power Supply enable flip-flop U9A. Thus providing resetting and/or clearing of all functions and registers on a power-on or crowbar reset operation.

4-56. The V_{LIM} dac U2 is the industry standard DAC-08 8-bit monolithic dac. Figure 4-10 provides a functional block diagram of this T0-116 16-pin device.

4-57. Operational amplifier U1 with its 4.99 k Ω feedback resistor R1, functions as a current-to-voltage converter and provides a 0 to 10 V V_{LIM} control signal to connector J1 pin 5. Potentiometer R5 V_{LIM} CAL provides full scale span adjustment.

4-58. Comparator U8A, provides level detection of the current control signal and the V_{LIM} control signal and outputs the $I > V_{LIM}$ status flag as a logic to multiplexer U22 via optical isolator U15A. Comparator U8B, provides level

detection of the current control signal and the voltage control signal to generate the $V > I$ status flag as a logic high to multiplexer U22 via optical isolator U15B. Comparators U8C and U8D provides a comparison of the normalized-sense 0-10 V signal ($-V_N$) and the voltage control 0-10 V signal, if they are not equal, an UNREG status flag is generated and applied to multiplexer U22 via optical isolator U14A.

4-59. The following circuit analysis of the 16-Bit DAC Subassembly is referenced to figure 4-11 Functional Diagram and schematic diagram 7-07902901 located in chapter 7 of this manual.

4-60. The four 4-bit data registers U3, U4, U5 and U6 allows for a 4-bit data interface, by providing a 16-bit parallel latch. The four latches are controlled by address bits a4 through a7 when installed in the voltage dac position (A2) or a8 through a11 when installed in the current dac position (A1).

4-61. U2 is a 16-bit hybrid dac configured in a 24-pin dual-in-line ceramic package. The dac is laser-trimmed to $\pm 0.003\%$ full scale range with a temperature coefficient of ± 20 ppm/ $^{\circ}\text{C}$.

4-62. Operational amplifier U1 functions as a current-to-voltage converter

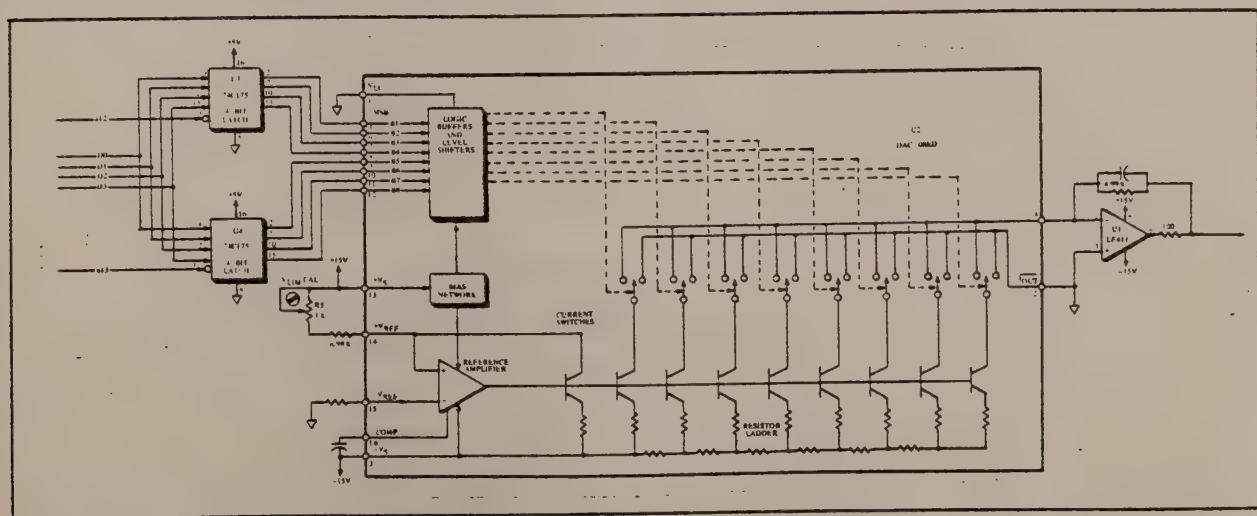


Figure 4-10. V_{LIM} DAC Functional Block Diagram

and provides 0 to 10 V control signal across output pins 4 and 5. The sensed output is feed back via 118 Ω resistor R5 to U2 pin 17 and its internal 5 k Ω feed back resistor. Potentiometer R2 (CAL) provides a full scale span adjustment. Potentiometer R1 (ZERO) provides for trimming out any offset. The offset (ZERO) adjustment should be made prior to span adjustment.

4-63. The following circuit analysis of the 12-bit DAC Subassembly is referenced to figure 4-12 Functional Diagram and the schematic 7-07902801 located in chapter 7 of this manual.

4-64. The four address bits are designated a4 through a7 when the subassembly is installed in the voltage dac position (A2). When the subassembly is installed in the current dac position (A1) the address bits are designated a8 through a11.

4-65. U2 is a 12-bit microprocessor compatible hybrid dac configured in a

28-pin dual-in-line package. U2 has its own internal 12-bit double buffered parallel latches which allows for the 4-bit data interface. The internal latches are controlled by the address inputs A0 through A3.

4-66. U2 has an internal Zener reference which is laser-trimmed to $\pm 1\%$ full scale range with a temperature coefficient of ± 10 ppm/ $^{\circ}\text{C}$.

4-67. Operational amplifier U1 functions as a current-to-voltage converter and provides a 0 to 10 V control signal across output pins 4 and 5. The dac's REF OUT at U2 pin 6 is adjusted by potentiometer R2 (CAL) and applied back to its REF IN at U2 pin 8. Potentiometer R1 (ZERO), will zero out any offset. The dac output U2 pin 2 is applied operational amplifier U1. A 137 Ω resistor R5 is series with the internal gain resistor at U2 pin 3 FB RES to provide a nominal full scale range of greater than 10 V.

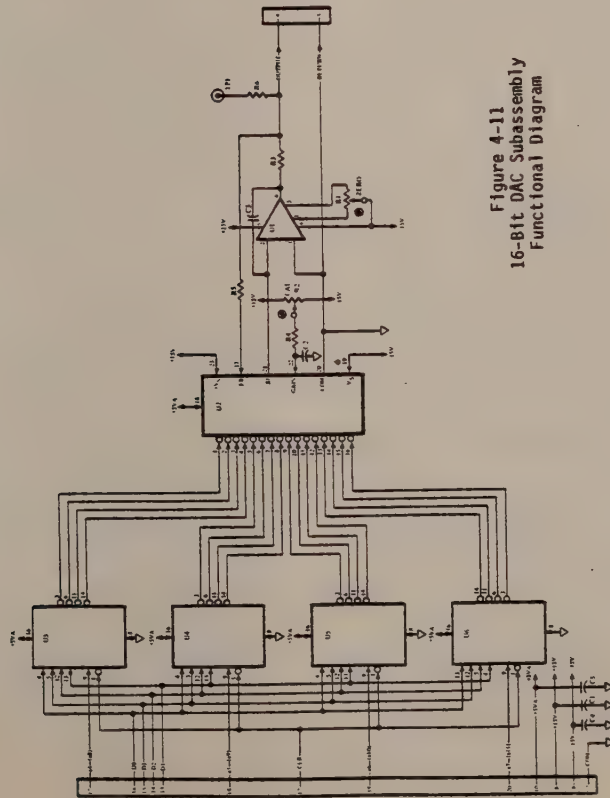


Figure 4-11
16-Bit DAC Subassembly
Functional Diagram

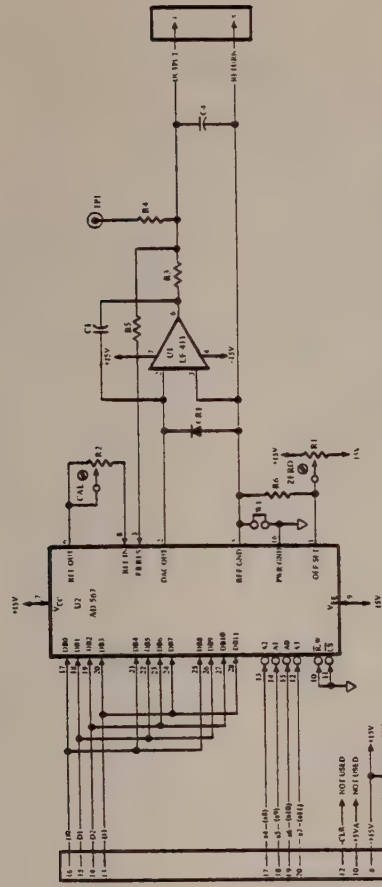


Figure 4-12
12-Bit DAC Subassembly
Functional Diagram

CHAPTER 5

MAINTENANCE

5-1. INTRODUCTION

5-2. The chapter contains procedures for preventive maintenance, corrective maintenance, performance tests and calibration of the P6/P12 Programmers.

5-3. PREVENTIVE MAINTENANCE

5-4. Preventive maintenance consists primarily of cleaning and visual inspection. When performed on schedule, preventive maintenance will prevent possible breakdown and improve the reliability of the programmer. Severity of environment, to which the programmer is subjected, will determine the frequency of the periodical maintenance schedule. A convenient time to perform a preventive maintenance schedule is just before recalibration.

5-5. Cleaning

5-6. The programmer covers provide protection against dust in their interiors. Operation with covers removed will necessitate more frequency cleaning, and will effect the performance of the unit by upsetting its interior thermal balance making it more susceptible to electromagnetic interference (EMI).

CAUTION

Certain components within the programmer can be damaged by use of carbon-based solvents. Avoid use of chemicals that contain acetone, benzene, toluene, xylene, petroleum ether, kerosene, carbon tetrochloride, methylene, chloride, and trichlorotrifluoroethane (i.e., freon 113, -tf-ta-me). Recommended agents for interior cleaning are isopropyl alcohol or kelite (1 part kelite to 30 parts water). It is safe to use ethyl alcohol and methyle alcohol if the recommended solvents are not available.

5-7. Interior Cleaning

5-8. Dust on the interior of the unit must be removed due to its electrical conductivity when high-humidity is present. Dust can also cause overheating and component breakdown. Dust or dirt on components surfaces acts as a thermal insulating blanket and thus prevents heat sinking, which can lead to component failure. The recommended way to remove accumulated dust is to blow it off with dry oil-free low pressure air (approximately 10 lbs/in²). Any dirt that remains should be removed with a soft brush or lint free cloth dampened with a proper cleaning agent. A cotton-tipped applicator ("Q-tip") should be used to clean in narrow spaces or around components on the printed circuit boards

5-9. Exterior Cleaning

5-10. Dirt accumulated on the exterior of the programmer may be removed with a soft cloth or a small paint brush dampened with a mild detergent and water solution. Abrasive cleanser should never be used.

5-11. Lubrication

5-12. All adjustment potentiometers used in the programmer were installed with proper lubrication where necessary and will rarely require any additional lubrication. Thus it is recommended that a regular periodic lubrication program not be performed on the programmer.

5-13. Visual Inspection

5-14. Visually inspect the programmers mechanical integrity for such items as loose plug-in pcb assemblies, loose or detached cable assemblies, etc. Then check the chassis, pcb assemblies, and modules for mechanical and thermal damage, i.e., broken, bent, discolored or charred component parts.

5-15. The corrective procedure for most of the visible defects is obvious; however, particular care must be taken if thermal damage is noted. Overheating usually indicates other trouble in the subject module; therefore, it is important that the cause of overheating be corrected to prevent possible recurrence of thermal damage to the replaced component.

5-16. CALIBRATION

5-17. The following procedure is provided for calibrating the DAC PCB Assemblies installed in the Programmer. After the initial calibration following their installation into the system, the recommended calibration interval is 6 months.

NOTE

Calibration procedure for all the DAC PCB Assemblies is identical except for entering the appropriate channel number and use of the assigned full scale values of voltage, current and V_{LIM} for each DAC channel. The full scale values are stored in the firmware (PROM A2A0U13) of the Interface PCB Assembly and is unique to the systems configuration. Refer to the appropriate systems manual for the full scale values of each active channel.

5-18. Equipment Required

5-19. The following equipment is required to perform the DAC calibration.

1. Instrument Controller/Computer (Commodore PET with 32 k memory and IEEE-488 GPIB interface, or equivalent).
2. IEEE-488 GPIB Cable.
3. DMM, 5-1/2 digit, with 0.01% or better accuracy on the 10 V dc range.

5-20. DAC-4 Calibration Procedure

NOTE

The adjustment potentiometers and test points can be access through cut-outs on the top cover of the programmer. The call outs in the following procedure are as labeled on the top cover.

1. Verify that the programmer is properly configured for the appropriate programmable power supply system. Refer to the systems manual for system configuration.
2. Ensure that the 5-digit address switch A2A0S2 located on Interface PCB Assembly is set to the system assigned IEEE-488 GPIB address. When the P6/P12 is shipped from the factory the address switch is set to 01010.
3. Apply power to the system and allow 20 minutes for stabilization.
4. Enter the following ASCII commands via the GPIB: DIAG XX SET VOLT 0 SET CURL SET VLTL 0 (where "xx" is the channel number 01 through 13). Connect the DMM common lead to common test point TP4 (yellow) on the DAC-4 Assembly being calibrated.
5. Monitor test point TP3 (orange) with the DMM and adjust potentiometer R14 VOLT. ZERO for a reading of 0.0000 V on the DMM.
6. Monitor test point TP2 (red) and adjust potentiometer R7 CUR. ZERO for a reading of 0.000 V on the DMM.
7. Monitor test point TP1 (brown) and verify a DMM reading of less than 20 mV (there is no adjustment provided for the V_{LIM} zeroing).

8. Enter the following commands via the GPIB: SET VOLT vfs (where "vfs" and "ifs" are the full scale ratings assigned the channel in volts and amperes).
9. Monitor test point TP3 (orange) and adjust potentiometer R13 VOLT. CAL. for a reading of 10.000 V on the DMM.
10. Monitor test point TP2 (red) and adjust potentiometer R11 CUR. CAL. for a reading of 10.000 V on the DMM.
11. Monitor test point TP1 (brown) and adjust potentiometer R6 V LIM. for a reading of 10.000 V on the DMM.
12. Enter RTS DSC :CHxx via the GPIB (where "xx" is the channel number) to reset the channel.
13. Repeat steps 4 through 12 for each DAC-4 Assembly installed and assign a channel number.
3. Apply power to the system and allow 20 minutes for stabilization.
4. Enter the following ASCII commands via the GPIB; DIAG XX SET VOLT 0 SET CURL SET VLTL 0 (where "xx" is the channel number 01 through 13). Connect the DMM common lead to test point TB2 on the DAC-400 Series being calibrated.
5. Monitor test point A2TP1 with the DMM and adjust potentiometer A2R1 ZERO for a reading of 0.0000 V on the DMM.
6. Monitor test point A1TP1 and adjust potentiometer A1R1 ZERO for a reading of 0.0000 V on the DMM.
7. Monitor test point TP1 and verify a DMM reading of less than 20 mV (there is no adjustment provided for the V_{LIM} zeroing).

5-21. DAC-400 Series Calibration Procedure

NOTE

The adjustment potentiometers and test points can be access through cut-outs on the top cover of the Programmer.

1. Verify that the Porgrammer is properly configured for the appropriate Programmable Power Supply System. Refer to the Systems Manual for system configuration
2. Ensure that the 5-digit address switch A2A0S2 located on Interface PCB Assembly is set to the system assigned IEEE-488 GPIB address. When the P6/P12 is shipped from the factory the address switch is set to 01010.
9. Monitor test point A2TP1 and adjust potentiometer A2R2 CAL for a reading of 10.000 V on the DMM.
10. Monitor test point A1TP1 and adjust potentiometer A1R2 CAL for a reading of 10.000 V on the DMM.
11. Monitor test point TP1 and adjust potentiometer R5 V_{LIM} CAL for a reading of 10.000 V on the DMM.
12. Enter RTS DSC :CHxx via the GPIB (where "xx" is the channel number) to reset the channel.
13. Repeat steps 4 through 12 for each DAC-400 Series Assembly installed and assign a channel number.

NOTE

In some systems the diagnostic command (DIAG n) is not programmable. When calibrating such a system, modify the calibration procedure as follows:

Step 4. Enter the following ASCII commands via the GPIB
FNC DCS :CHn RST DCS :CHn.

Step 6 for a reading of 0.0005 V on the DMM.

Step 7 verify a DMM reading of 0.08 ± 0.002 V.

5-22. PERFORMANCE TEST

5-23. The performance specifications of the P6/P12 covering the resolution accuracy and analog outputs given in table 1-1 located in chapter 1 of this manual can be demonstrated only at the system level. Refer to the appropriate systems manual for the performance test procedures relating to the Programmer.

CHAPTER 6

REPLACEABLE PARTS

6-1. INTRODUCTION

6-2. This chapter contains the parts lists for each assembly in the P6/P12 Power Supplies. Chapter 7 shows the assemblies where the listed parts are installed. Ordering information is included and should be used when purchasing parts from the factory. Explanation of the column listings and Table 6-1 Manufacturer's Code-To-Name Index are also included.

6-3. PART ORDERING INFORMATION

6-4. To order a part from the Replaceable Parts List, state the Systron Donner part number, indicate the quantity required and address the order to the nearest Systron Donner Sales or Service Center.

6-5. To order a part not listed in the Replaceable Parts List, state the instrument model number, instrument serial number, the description and function of the part and the number of parts required. Address the order to the nearest Systron Donner Sales or Service Center.

6-6. PARTS LISTS

6-7. Replaceable parts lists are listed for each assembly, sub-assembly in the unit. Each column in the parts lists provide specific information relating to the listed parts as follows:

(1) ITEM: This is the find number column and list those find numbers as called out on the respective assembly drawing.

(2) REFERENCE DESIGNATOR: Reference numbers applicable to assemblies are listed in alphanumeric order.

(3) COMPONENT NOMENCLATURE AND DESCRIPTION: Component names and specifications are provided in these columns and include value, tolerance, wattage rating, working voltage, construction, etc.

(4) MANUFACTURER'S CODE: H4-2 Federal Supply Code numbers are listed to identify component manufacturers. A Manufacturers Index is provided in this chapter for cross reference.

(5) MANUFACTURER'S PART NUMBER: True manufacturer part numbers are listed in this column.

(6) SD STOCK NUMBER: The Systron Donner stock number is listed in this column.

(7) T/Q (Total Quantity): This quantity, appearing after an item entry, indicates the number of times the component is used in that assembly. The total quantity for each part is given only once-at the first appearance of the part number in the list.

Table 6-1. Manufacturer's Code-To-Name Index

Mfr. Code	Manufacturer Name	Address	Zip Code
01121	Allen Bradley Co.	Milwaukee, WI	53203
01295	Texas Instruments Inc. Semi-conductor and Components Div.	Dallas, TX	75265
02660	Bunker Ramo Corp. Amphenol Div.	Broadview, IL	60153
03508	General Electric Co. Semiconductor Products Div.	Auburn, NY	13021
04222	AVX Ceramics Div.-AVX Corp.	Myrtle Beach, SC	29577
04713	Motorola Semiconducts Prod.Div.	Phoenix, AZ	85008
05574	Viking Connectors Inc.	Chatsworth, CA	91311
06383	Panduit Corp.	Tinley Park, IL	60477
06540	Mite Corp. Amatom Electronic Hardware Div.	New Haven, CT	06515
06776	Robinson Augent Inc.	New Albany, IN	41750
08547	R. G. Wallace Co. Inc.	Compton, CA	90220
09353	C and K Components Inc.	Newton, MA	02158
09922	Burndy Corp.	Norwalk, CT	06856
11237	CTS Keene Inc.	Paso Robles, CA	93446
15513	Data Display Products	Los Angeles, CA	90045
15636	Elec-Trol Inc.	Saugus, CA	91350
18324	Signetics Corp.	Sunnyvale, CA	94086
19701	Mepco/Electra Inc.	Mineral Wells, TX	76067
24335	Cooper Laboratories Inc.	Wayne, NJ	07470
26066	Minnesota Mining and Mfg. Co. Industrial Tape Division	St. Paul, MN	55101
27014	National Semiconductors Corp.	Santa Clara, CA	95051
27264	Molex Inc.	Lisle, IL	60532
28480	Hewlett-Packard Co.	Palo Alto, CA	94304
28520	Heyman Mfg. Co.	Kenilworth, NJ	07033
31918	International Electro Exchange Inc.	Eden Prairie, NM	55343
34649	Intel Corp.	Santa Clara, CA	95051
52542	Systron Donner Corp. Instrument Div.	Concord, CA	94518
54453	Sullins Electronic Crop.	San Marcos, CA	92069
55210	Gettig Engineering and Mfr.	Spring Mill, PA	16875
56289	Sprague Electric Co.	North Adams, MA	01247
71468	ITT Cannon	Fountain Valley, CA	92708
73138	Beckman Instruments Inc. Helipot Div.	Fullerton, CA	92634
73803	Texas Instruments Inc.	Attleboro, MA	02703
74840	Illinois Capacitor Inc.	Lincolnwood, IL	60645
75378	CTS Knights Inc.	Sandwich, IL	60548
75915	Tracor Littlefuse Inc.	Des Plaines, IL	60016
78189	Illinois Tool Works Inc. Shakeproof Div.	Elgin, IL	60120
78553	Tinnerman Products Inc.	Cleveland, OH	44129
79963	Zierick Mfg. Co.	Mount Kisco, NY	10549

Table 6-1. Manufacturer's Code-To-Name Index (Cont'd)

Mfr. Code	Manufacturer Name	Address	Zip Code
80205	National Aerospace Standard		
81349	MIL Specifications		
82389	Switchcraft Inc.	Chicago, IL	60630
82647	Texas Instruments Inc.	Attleboro, MA	02703
	Control Products Div.		
86928	Seastrom Mfg. Co. Inc.	Glendale, CA	91201
88245	Litton Systems Inc. USECO Div.	Van Nuys, CA	91409
91506	Augat Inc.	Attleboro, MA	02703
91637	Dale Electronics Inc.	Columbus, NE	68601
94222	Southco Inc.	Lester, PA	19113
95987	Weckesser Co. Inc.	Chicago, IL	60641
96733	San Fernando Electric Mfg. Co.	San Fernando, CA	91341
96906	MIL Specifications		
98159	Rubber Teck Inc.	Gardena, CA	90247
99392	S T M Corp.	Oakland, CA	94601

REPLACEABLE PARTS LIST

TITLE P6 Programmer Shipping Assembly 06580301 Rev C (Figure 7-1)						
ITEM	REF	COMPONENT DESCRIPTION	MFR'S CODE	MANUFACTURER'S PART NUMBER	SD STOCK NUMBER	T/Q
1		ASSEMBLY, Top Cover	52542	06597601	06597601	1
2		ASSEMBLY, P6 Test	52542	06576901	06576901	1
7		CORD, AC Power 8'	52542	102407	102407	1
8		SCREW, PHMS 6-32 x 3/8	96906	MS51957-28	10063206	1
9		WASHER, Int Tooth No. 6	96906	MS35333-71	100647	1
10		WASHER, Flat No. 6	86928	5710-23-10	100662	1
11		SCREW, FHMS 6-32 x 3/8	96906	MS24693-C26	10073106	2
12		SCREW, PHMS 6-32 x 3/8 Black Oxide	96906	MS51958-28B	12304706	2

REPLACEABLE PARTS LIST

TITLE Top Cover Assembly 06597601 Rev A (Figure 7-2)						
ITEM	REF	COMPONENT DESCRIPTION	MFR'S CODE	MANUFACTURER'S PART NUMBER	SD STOCK NUMBER	T/Q
1		FAB, Cover	52542	06581401	06581401	1
2		INSULATOR, Dampener	52542	06597801	06597801	3
3		TAPE	26066	924	116953	A/R

REPLACEABLE PARTS LIST

TITLE P6 Test Assembly 06576901 Rev C (Figure 7-10)						
ITEM	REF	COMPONENT DESCRIPTION	MFR'S CODE	MANUFACTURER'S PART NUMBER	SD STOCK NUMBER	T/Q
1		ASSEMBLY, Front Panel	52542	06581601	06581601	1
2	A1	ASSEMBLY, +5V	52542	06924502	06924502	1
3	A2	ASSEMBLY, Bus PC	52542	06579601	06579601	1
4		ASSEMBLY, Cable IEEE	52542	06925302	06925302	1
5	A2A0	ASSEMBLY, Interface PC	52542	06577501	06577501	1
6		ASSEMBLY, PC Support Bracket	52542	06582101	06582101	1
7		ASSEMBLY, PC Support Bracket	52542	06582201	06582201	1
8		ASSEMBLY, Transformer Cable	52542	06585901	06585901	1
9	J101 thru J107	ASSEMBLY, DAC-4 Cable	52542	06583301	06583301	A/R
24	A2A1 thru A2A7	ASSEMBLY, DAC-4 PC	52542	06576501	06576501	A/R
24	A2A1 thru A2A7	ASSEMBLY, DAC-4XX Parent PC	52542	07902601	07902601	A/R
10		CHASSIS, Fab	52542	06580201	06580201	1
11		PLATE, Cover	52542	03141811	03141811	Ref
12		FAB, Support Bar	52542	06582601	06582601	2
14	J1	CONNECTOR, Power	82389	EAC-301	101288	1
15	XF1	FUSE POST	75915	345002	117381	2
16	XF2	Same as XF1				
	F1	FUSE, .75 A	75915	313.750	100603	2
	F2	Same as F1				
17	J3	RECEPTICAL	02660	31-2225	11940601	1
18	S1	SWITCH, Toggle	09353	7101-P3-Y1-Z-Q	102346	1
19		BUSHING	28520	2020/SB-375-3	11983001	2
20		LABEL	52542	07382601	07382601	1
22		SPRING, P/O J101	71468	D110277	11981701	Ref
23		WASHER, 1/2" Int Tooth	78189	1224-02 CAD	100657	2
25		SPACER	52542	075197	075197	2
26		WASHER, Flat No. 6	86928	5710-23-10	100662	6
27		NUT, Kep 6-32	78189	511-061800-00	100862	8
30		WASHER, Int Tooth No. 6	96906	MS35333-71	100647	2
31		SCREW, PHMS 6-32 x 1/2	96906	MS51957-30	10063208	2
32		SCREW, PHMS 4-40 x 3/8	96906	MS51957-15	10062606	Ref

REPLACEABLE PARTS LIST

TITLE P6 Test Assembly 06576901 (Cont'd)						
ITEM	REF	COMPONENT DESCRIPTION	MFR'S CODE	MANUFACTURER'S PART NUMBER	SD STOCK NUMBER	T/Q
33		NUT, Kep 4-40	78189	511-041800-00	100941	2
34		NUT, Hex 10-32	78189	511-101800-50	100939	2
35		CLAMP, Cable	95987	5/16-4NA	100717	1
36		SPIRAL WRAP	06383	T25F	11980501	A/R
37		WASHER, Flat No. 8	96906	MS15795-807	100705	2
38		NUT, Hex 8-32	78189	51-101800-01	100940	2
39		SCREW, PHMS 4-40 x 7/16	96906	MS51957-16	10062607	2
40		WASHER, Flat No. 4	80205	NAS620-42	100683	2
41		TIE, Cable	96906	MS33674-9	100753	6
42		INSULATOR, Dampener	52542	06597802	06597802	1
43		TAPE, Adhesive .75W	26066	924	116953	A/R
1		ASSEMBLY, Option T2 (Extended)	52542	07900201	07900201	A/R

REPLACEABLE PARTS LIST

TITLE Front Panel Assembly 06581601 Rev A (Figure 7-3)						
ITEM	REF	COMPONENT DESCRIPTION	MFR'S CODE	MANUFACTURER'S PART NUMBER	SD STOCK NUMBER	T/Q
1	DS1	FAB, Front Panel	52542	06577901	06577901	1
3		HANDLE	06540	10854-A-0832-2	11971201	1
4		SCREW, FHMS 8-32 x 3/8	96906	MS24693-C48	10074306	2
6		FASTENER, Cap 8-32	94222	51-17-809-24	11971001	2
7		LED, Green	15513	91-BG5H-NGO	103353	1
8		NUT, Pushon	78553	C185-014-4	103001	1

REPLACEABLE PARTS LIST

TITLE PC Support Bracket Assembly 06582101 Rev A (Figure 7-4)						
ITEM	REF	COMPONENT DESCRIPTION	MFR'S CODE	MANUFACTURER'S PART NUMBER	SD STOCK NUMBER	T/Q
1		FAB, Bracket	52542	06580701	06580701	1
2		GUIDE, PC		23071-1	11970901	8

REPLACEABLE PARTS LIST

TITLE PC Support Bracket Assembly 06582201 Rev A (Figure 7-5)						
ITEM	REF	COMPONENT DESCRIPTION	MFR'S CODE	MANUFACTURER'S PART NUMBER	SD STOCK NUMBER	T/Q
1		FAB, Bracket	52542	06580702	06580702	1
2		GUIDE, PC		23071-3	11971101	8
3	TB1	CONNECTOR, Rectangular	27264	07-01-7101	116547	2
4	TB2	Same as TB1				
5		SCREW, PHMS 4-40 x 3/8	96906	MS51957-15	10062606	4
5		WASHER, Int Tooth No. 4	96906	MS35333-70	100794	4
6		WASHER, Flat No. 4	80205	NAS620-42	100683	4

REPLACEABLE PARTS LIST

TITLE Transformer Cable Assembly 06585901 Rev B						
ITEM	REF	COMPONENT DESCRIPTION	MFR'S CODE	MANUFACTURER'S PART NUMBER	SD STOCK NUMBER	T/Q
	T1	TRANSFORMER	52542	504364	504364	1
		TERMINAL	14726	R4149SFT	123095	1
		CONNECTOR, Shell 11-pos	27264	22-01-2116	11972601	2
		CONNECTOR, Termination	27264	08-50-0114	11972101	18
		CONNECTOR, Termination	27264	05-02-0048	116548	4
		SPIRAL WRAP	06383	T25F	11980501	A/R

REPLACEABLE PARTS LIST

TITLE A1, +5 V Power Supply Assembly 06924502 Rev A (Figure 7-7)						
ITEM	REF	COMPONENT DESCRIPTION	MFR'S CODE	MANUFACTURER'S PART NUMBER	SD STOCK NUMBER	T/Q
2	A1	ASSEMBLY, +5 V PC	52542	06917802	06917802	1
3		CHASSIS	52542	06930201	06930201	1
4	T1	TRANSFORMER	52542	504365	504365	1
5	U1	INTEGRATED CIRCUIT	27014	LM317K	116638	1
		Voltage Regulator +37 V				
6	XU1	SOCKET	06776	MD-3452-G	830101	1
7		INSULATOR, T03	08289	DM111	103358	1
8		SCREW, Sht Metal 6 x 1/2	73734	7112	100624	2
9		SCREW, PHMS 6-32 x 3/8	96906	MS51957-28	10063206	2
10		WASHER, Int Tooth No. 6	96906	MS35333-71	100647	4
12		SCREW, PHMS 4-40 x 1-3/8	08547	By Description	100879	2
13		WASHER, Flat No. 4	96906	MS15795-803	100703	3
14		NUT, Kep 4-40	78189	511-041800-00	100941	2
15		TIE, Cable	96906	MS33674-9	100753	3
15		CONNECTOR, Termination	27264	05-02-0048	116548	4

REPLACEABLE PARTS LIST

TITLE A1A1, +5 V PC Assembly 06917802 Rev A (Figure 7-8)						
ITEM	REF	COMPONENT DESCRIPTION	MFR'S CODE	MANUFACTURER'S PART NUMBER	SD STOCK NUMBER	T/Q
3		BOARD, PC	52542	06917302	06917302	1
	C1	CAPACITOR, El Ax 8000 μ F +50-10%, 16 V	74840	808TTA016A	11966401	1
	C2	CAPACITOR, Ceramic 1 μ F 20%, 50 V	56289	5CZ5U105X 0050C5	100176	1
	C3	CAPACITOR, Tant 10 μ F 10%, 20 V dcw	56289	150D106X 9020B2	100063	1
	CR1	DIODE, Rectifier 100 V	04713	1N4720	720454	2
	CR2	Same as CR1				
	R1	RESISTOR, MF 750 Ω 1%, .5 W	81349	RN65D7500F	620250	1
	R2	RESISTOR, MF 249 Ω 1%, 1/4 W	81349	RN65D2490F	620080	1
13		SPACER, 6-32	06540	9541C-B-0632- 3A	100977	2
14		TIE, Cable	98159	2829-115-4	100848	1
15		TERMINAL, Swage	88245	1309B-1	100508	10

REPLACEABLE PARTS LIST

TITLE A2, Bus PC Assembly 06579601 Rev B (Figure 7-6)						
ITEM	REF	COMPONENT DESCRIPTION	MFR'S CODE	MANUFACTURER'S PART NUMBER	SD STOCK NUMBER	T/Q
1		BOARD, PC	52542	06579501	06579501	1
4	XA0	CONNECTOR, PC Edge	54453	ISM12DRTN-S50	103747	1
3	XA1 thru XA7	CONNECTOR, PC Edge	05574	2VK18D/4-12	103190	7
6	J1	CONNECTOR, PC Pin	27264	09-67-1033	11972501	1
5	J2	CONNECTOR, PC Pin	27264	22-03-2111	11972401	2
	J3	Same as J2				
8	J4	CONNECTOR, PC Pin	27264	22-03-2031	11980601	1
7	DFI	CONNECTOR, Pin	79963	835	11965901	2

REPLACEABLE PARTS LIST

TITLE A2A0, Interface PC Assembly 06577501 Rev D (Figure 7-14)						
ITEM	REF	COMPONENT DESCRIPTION	MFR'S CODE	MANUFACTURER'S PART NUMBER	SD STOCK NUMBER	T/Q
1		BOARD, PC	52542	06577401	06577401	1
	C1	CAPACITOR, DP Ceramic 0.01 μ F 20%, 100 V	04222	3429100C103M	117570	13
	C2	Same as C1				
	C3	CAPACITOR, Ceramic 1 μ F 20%, 50 V	56289	5CZ5U105X0050C5	100176	6
	C4	Same as C3				
	C5	Same as C1				
	C6	CAPACITOR, Ceramic 6800 pF 10%, 50 V	20932	5032E0100RD682K	103929	1
	C7 thru C12	Same as C1				
	C13	CAPACITOR, Tant 100 μ F 10%, 10 V	56289	196D107X9010PE4	103714	2
	C14	CAPACITOR, DP Ceramic 220 pF 5%, 100 V	96733	DB44BY221J	117633	1
	C15	CAPACITOR, DP Ceramic 33 pF 5%, 100 V	96733	DB44BY330J	117471	1
	C16	Same as C3				
	C17	Same as C1				
	C18	Same as C1				
	C19	Same as C3				
	C20	CAPACITOR, DP Ceramic 470 pF 5%, 100 V dcw	96733	DB45BY471J	117637	3
	C21	Same as C1				
	C22	Same as C20				
	C23	Same as C20				
	C24	Same as C3				
	C25	Same as C13				
	C26	Same as C3				
	C27	Same as C1				
	CR1	DIODE, Signal 50 V	03508	1N4151	100385	1
	K1	RELAY, Reed 5 V	15636	RA3023	101293	1
	Q1	TRANSISTOR, SINPN 40 V	04713	2N3904	101377	1
	R1	RESISTOR, CC 3 k Ω 5%, 1/4 W	01121	CB3025	10154801	3
	R2	Same as R1				

REPLACEABLE PARTS LIST

TITLE A2A0, Interface PC Assembly 06577501 (Cont'd)						
ITEM	REF	COMPONENT DESCRIPTION	MFR'S CODE	MANUFACTURER'S PART NUMBER	SD STOCK NUMBER	T/Q
	R3	RESISTOR, CC 470 Ω 5%, 1/4 W	01121	CB4715	10162501	2
	R4	Same as R3				
	R5	RESISTOR, CC 1 k Ω 5%, 1/4 W	01121	CB1025	10156901	1
	R6	RESISTOR, MF 118 k 1%, .1 W	91637	CMF-55-T9	119154	1
	R7	RESISTOR, CC 100 k Ω 5%, 1/4 W	01121	CB1045	10155801	2
	R8	Same as R7				
	R9	RESISTOR, CC 24 k Ω 5%, 1/4 W	01121	CB2435	10155401	1
	R10	RESISTOR, CC 10 k Ω 5%, 1/4 W	01121	CB1035	10157001	1
	R11	RESISTOR, CC 5.1 k Ω 5%, 1/4 W	01121	CB5125	10154101	1
	R12	Same as R1				
	R13	RESISTOR, CC 100 Ω 5%, 1/4 W	01121	CB1015	10160901	1
	RN1	RESISTOR, Module 7-10 k	01121	108A10K	11938101	2
	RN2	Same as RN1				
	S2	SWITCH, Dip 5-pos	11237	206-5	117374	1
	U1	INTEGRATED CIRCUIT, TTL SSI Dual D Flip-Flop	01295	SN74LS74AN	103132	1
	U2	INTEGRATED CIRCUIT, MOS MPU W/Clock and Ram	04713	MC6802P	116285	1
	U3	INTEGRATED CIRCUIT μ P Programmable Interface	04713	MC6821P	116281	1
	U4	INTEGRATED CIRCUIT, TTL SSI Hex Inverter	01295	SN74LS04N	103749	2
	U5	INTEGRATED CIRCUIT, MOS General Purpose Interface	04713	MC68488P	116430	1
	U6	INTEGRATED CIRCUIT, LIN MSC 8 x Converter	04713	MC3447P1	117956	2
	U7	Same as U4				
	U8	INTEGRATED CIRCUIT, LIN MSC Wide Range Timer	18324	NE555V	045208	2
	U9	Same as U8				
	U10	INTEGRATED CIRCUIT, TTL SSI Quad 2-input OR Gate	01295	SN74LS32N	103972	1

REPLACEABLE PARTS LIST

TITLE A2A0, Interface PC Assembly 06577501 (Cont'd)						
ITEM	REF	COMPONENT DESCRIPTION	MFR'S CODE	MANUFACTURER'S PART NUMBER	SD STOCK NUMBER	T/Q
	U11	INTEGRATED CIRCUIT, TTL 8 Bit Inv. Buffer Line Driver	01295	SN74LS240N	11984401	3
	U12	INTEGRATED CIRCUIT, RAM	34649	2128-20	11944001	1
	U13	INTEGRATED CIRCUIT, EPROM	52542	See System Manual		Ref
	U14	INTEGRATED CIRCUIT, TTL MSI Dual 2 to 4 Decoder	01295	SN74LS155N	116116	1
	U15	INTEGRATED CIRCUIT, TTL SSI 4-2 In Exclusive OR Gate	01295	SN74LS136N	116923	1
	U16	INTEGRATED CIRCUIT, TTL SSI Dual Retrigger One Shot MV	01295	SN74LS123N	103976	2
	U17	Same as U16				
	U18	INTEGRATED CIRCUIT, TTL MSI 4 Bus Transceiver	82647	SN74LS242N	11939301	1
	U19	Same as U11				
	W1 thru W4 W5	JUMPER, Insulated Not Used	55210	L-2007-1	102879	4
84	XU2 XU3 XU5	SOCKET, IC 40-pin Same as XU2 Same as XU2	09922	DILB40P-108	117159	3
85	XU1 XJ1	SOCKET, IC 24-pin Same as XU12	82647	C8424-02	103845	2
86	XU13	SOCKET, IC 28-pin	73803	C84-28-02	116143	1
	Y1	CRYSTAL, 4 MHz	75378	MP040	116286	1
		TERMINAL, Press	98921	001-1007-470	100575	2

REPLACEABLE PARTS LIST

TITLE A2A1 through A2A7, DAC-4 PC Assembly 06576501 Rev B (Figure 7-12)						
ITEM	REF	COMPONENT DESCRIPTION	MFR'S CODE	MANUFACTURER'S PART NUMBER	SD STOCK NUMBER	T/Q
1		BOARD, PC	52542	06577701	06577701	1
	C1	CAPACITOR, Ceramic 0.1 μ F 20%, 50 V	56289	5C023104X0500 C5	100178	3
	C2	CAPACITOR, DP Ceramic 0.01 μ F 20%, 100 V	04222	3429100C103M	117570	1
	C3	Same as C1				
	C4	CAPACITOR, DP Ceramic 10 pF 5%, 100 V	96733	DB44BY100J	117621	2
	C5	Same as C4				
	C6	CAPACITOR, Ceramic 0.001 μ F 10%, 100 V	04222	3418100C102K	117568	3
	C7	CAPACITOR, Ceramic 1 μ F 20%, 50 V	56289	5CZ5U105X0050 C5	100176	1
	C8	CAPACITOR, DP Ceramic 27 pF 5%, 100 V	96733	DB44BY270J	117640	1
	C9 thru C15 C16	Same as C7				
	C17	Same as C7				
	C18	CAPACITOR, EI Ax 220 μ F -20/75%, 35 V	74840	227TTA035A	11982401	1
	C19	CAPACITOR, Tant 56 μ F 10%, 6 V	56289	150D566X900B2	100225	1
	C20 thru C23 C24	Same as C7				
	C25	CAPACITOR, EI Ax 420/720 μ F 35 V	99392	ET471X040A02	103383	1
	C26	Same as C6				
	CR1	DIODE, Bridge Rectifier	04713	MDA101A	11982501	1
	CR2	DIODE, Signal 70 prv	28480	5082-2800	100442	2
	CR3	Same as CR2				
	J1	SOCKET, 24-pin	91506	524-AG11D	11933801	1
	R1	RESISTOR, MF 4.99 k Ω 1%, 0.1 W	81349	RN55E4991F	119008	1
	R2	JUMPER, 0 Ω	55210	L-2007-1	102879	4
	R3	Not Used				

REPLACEABLE PARTS LIST

TITLE A2A1 through A2A7, DAC-4 PC Assembly 06576501 (Cont'd)						
ITEM	REF	COMPONENT DESCRIPTION	MFR'S CODE	MANUFACTURER'S PART NUMBER	SD STOCK NUMBER	T/Q
	R4	RESISTOR, MF 6.98 k 1%, .1 W	91637	CMF-55 T9	119023	1
	R5	RESISTOR, CC 1 k Ω 5%, 1/4 W	01121	CB1025	10159601	1
	R6	RESISTOR, Variable 1 k Ω 10%, 3/8 W	73138	89PR1K	102181	1
	R7	RESISTOR, Variable 50 k Ω 10%, 3/8 W	73138	89PR50K	102153	2
	R8	RESISTOR, CC 100 Ω 5%, 1/4 W	01121	CB1015	101609	5
	R9	RESISTOR, CC 100 k Ω 5%, 1/4 W	01121	CB1045	101558	3
	R10	RESISTOR, MF 137 Ω 1%, 1/8 W	81349	RN55D1370F	119928	2
	R11	RESISTOR, Variable 200 Ω 10%, 3/8 W	73138	89PR200	102120	2
	R12	Same as R8				
	R13	Same as R11				
	R14	Same as R7				
	R15	Same as R8				
	R16	Same as R9				
	R17	Same as R8				
	R18	Same as R10				
	R19	RESISTOR, CC 150 k 5%, 1/4 W	01121	CB1545	10160401	2
	R20 thru R22	RESISTOR, CC 13 k 5%, 1/4 W	01121	CB1335	10159401	3
	R23	RESISTOR, Set MF 10 k .2%, .1 W	52542	113041	113041	1
	R24	Same as R2				
	R25	Not Used				
	R26	RESISTOR, MF 100 k 1%, .1 W	81349	RN55D1000F	117589	2
	R27	Same as R26				
	R28	Same as R23				
	R29	Same as R24				
	R30	Same as R2				
	R31	Not Used				
	R32	Not Used				

REPLACEABLE PARTS LIST

TITLE A2A1 through A2A7, DAC-4 PC Assembly 06576501 (Cont'd)						
ITEM	REF	COMPONENT DESCRIPTION	MFR'S CODE	MANUFACTURER'S PART NUMBER	SD STOCK NUMBER	T/Q
	R33	RESISTOR, CC 20 k Ω 5%, 1/4 W	01121	CB2035	101607	1
	R34	Same as R9				
	R35	RESISTOR, CC 1.8 k Ω 5%, 1/4 W	01121	CB1825	101602	1
	R36	RESISTOR, CC 160 Ω 5%, 1/4 W	01121	CB1615	10174601	1
	R37	Same as R8				
	RN1	RESISTOR, MF 1.87 k 1%, .1 W	91637	CMF-55 T9	119255	1
	RN2	Same as RN1				
	RN3	RESISTOR, Module 8-360 Ω	01121	AB316B361	11982601	1
	RN4	RESISTOR, Module 5-15 k	73138	783-1-R15K	117559	1
	TP1	TEST POINT, Brown	91506	8041-1G3	100521	1
	TP2	TEST POINT, Red	91506	8041-1G4	100522	1
	TP3	TEST POINT Orange	91506	8041-1G5	100523	1
	TP4	TEST POINT Yellow	91506	8041-1G2	100524	1
	TP5	TEST POINT Green	91506	8041-1G7	100525	1
	U1	INTEGRATED CIRCUIT Operational Amplifier	27014	LF411CH	11982701	1
	U2	INTEGRATED CIRCUIT, DAC Assembly	24335	ADDAC-08ED	11983101	1
	U3	INTEGRATED CIRCUIT Operational Amplifier	27014	LF412CH	11982801	1
	U4	INTEGRATED CIRCUIT Quad Comparator	27014	LM339AN	11940501	1
	U5	INTEGRATED CIRCUIT Dual Opto Coupler	28480	HCPL2730	11983201	2
	U6	Same as U5				
	U7	INTEGRATED CIRCUIT Dual Opto Coupler	28480	HCPL2533	11938801	2
	U8	INTEGRATED CIRCUIT, CMOS Quad 2 line - 1 line	01295	SN74HC158N	11983501	1
	U9	INTEGRATED CIRCUIT, TTL Quad 2 Input Buffer	01295	SN74LS38N	117514	1
	U10	INTEGRATED CIRCUIT, TTL SSI Hex Inverter	01295	SN74LS14N	117083	2
	U11	INTEGRATED CIRCUIT, CMOS Quad Dual Flip Flop	04713	MC14175BCP	117533	2
	U12	Same as U11				
	U13	INTEGRATED CIRCUIT DAC Assembly	24335	AD567JD	11965601	2

REPLACEABLE PARTS LIST

TITLE A2A1 through A2A7, DAC-4 PC Assembly 06576501 (Cont'd)						
ITEM	REF	COMPONENT DESCRIPTION	MFR'S CODE	MANUFACTURER'S PART NUMBER	SD STOCK NUMBER	T/Q
	U14	Same as U13				
	U15	INTEGRATED CIRCUIT, CMOS Dual D Flip Flop	01295	SN74HC74N	11983601	1
	U16	INTEGRATED CIRCUIT, CMOS Dual 2-4 line Decoder	01295	SN74HC139N	11983701	2
	U17	INTEGRATED CIRCUIT, CMOS Hex Inverter	01295	SN74HC04N	11983801	2
	U18	Same as U7				
	U19	Same as U7				
	U20	INTEGRATED CIRCUIT, TTL Quad 2-Input NAND Gate	01295	SN74LS37N	11984001	2
	U21	Same as U20				
	U22	INTEGRATED CIRCUIT, CMOS Quad 2-Input NOR Gate	01295	SN74HC02N	11983901	1
	U23	INTEGRATED CIRCUIT, CMOS Dual One Shot	27014	MM74C221N	11941001	1
	U24	Same as U16				
	U25	Same as U17				
	U26	Same as U7				
	U27	INTEGRATED CIRCUIT Opto Isolator	28480	6N136	103019	1
	U28	INTEGRATED CIRCUIT, TTL SSI 4-2 In Exclusive OR Gate	01295	SN74LS136N	116923	1
	U29	INTEGRATED CIRCUIT, CMOS Hex Inverter ST	01295	SN74HC14N	11984101	1
	U30	Same as U10				
	U31	Same as U20				
	U32	INTEGRATED CIRCUIT Voltage Regulator	04713	MC7915CT	103040	1
	U33	INTEGRATED CIRCUIT Voltage Regulator 15 V	04713	MC7815CT	103039	1
	U34	INTEGRATED CIRCUIT Voltage Regulator	04713	MC78L05ACP	117101	1
	XU2	SOCKET, IC 16-pin	82647	C8816-01	117041	1
	XU13	SOCKET, IC 28-pin	73803	C9828-01	11984201	2
	XU14	Same as XU13				
		SCREW, PHMS 4-40 x 1/4	96906	MS51957-13	10062604	2
		WASHER, Int Tooth No. 4	96906	MS35333-70	100794	2
		ASSEMBLY, Cable	52542	06583301	06583301	1

REPLACEABLE PARTS LIST

TITLE A1-A7 DAC-4XX Parent PCB Assembly 07902601 Rev A (Figure 7-16)						
ITEM	REF	COMPONENT DESCRIPTION	MFR'S CODE	MANUFACTURER'S PART NUMBER	SD STOCK NUMBER	T/Q
1		BOARD, PC	52542	079026	079026	1
2		SPACER, Swage 4-40	71279	1300-9	100492	3
3		SCREW, PHMS 4-40 x 1/4	96906	MS51957-13	10062604	3
4		WASHER, Int Tooth No. 4	96906	MS35333-70	100794	3
5		SPACER, Swage 4-40	06540	9536B-A-0440-17	101062	4
	C1	CAPACITOR, DP Ceramic 27 pF 5%, 100 V	96733	DB44BY270J	117640	1
	C2	CAPACITOR, Ceramic 0.1 μ F 20%, 50 V	56289	5C023104X0500C5	100178	3
	C3	Same as C2				
	C4	CAPACITOR, DP Ceramic 0.01 μ F 20%, 100 V	04222	3429100C103M	117570	1
	C5 thru C8	CAPACITOR, Ceramic 1 μ F 20%, 50 V	56289	5CZ5U105X0050C5	100176	9
	C9	CAPACITOR, E1 Ax 420/720 μ F 35 V	99392	ET471X040A02	103383	2
	C10	Same as C9				
	C11	CAPACITOR, DP Ceramic 0.001 μ F 10%, 100 V	04222	3418100C102K	117568	1
	C12	Same as C2				
	C13	Same as C5				
	C14	CAPACITOR, Tant 56 μ F 10%, 6 V	56289	150D566X900B2	100225	1
	C15 thru C18	Same as C5				
	CR1	DIODE, Bridge Rectifier	04713	MDA101A	11982501	1
	CR2	DIODE, Signal 50 V	03508	1N4151	100385	2
	CR3	Same as CR2				
	J1	SOCKET, 24-pin	91506	524-AG11D	11933801	1
	R1	RESISTOR, Metal Film 4.99 k Ω 1%, 0.1 W	81349	RN55E4991F	119008	1
	R2	RESISTOR, CC 100 Ω 5%, 1/4 W	01121	CB1015	10160901	1
	R3	RESISTOR, CC 7.5 k 5%, 1/4 W	01121	CB7225	10159601	1
	R4	RESISTOR, CC 10 k Ω 5%, 1/4 W	01121	CB1035	10157001	2
	R5	RESISTOR, Variable 1 k Ω 10%, 3/8 W	73138	89PR1K	102181	1

REPLACEABLE PARTS LIST

TITLE A1-A7 DAC-4XX Parent PCB Assembly 07902601 (Cont'd)						
ITEM	REF	COMPONENT DESCRIPTION	MFR'S CODE	MANUFACTURER'S PART NUMBER	SD STOCK NUMBER	T/Q
	R6	RESISTOR, MF 6.98 k 1%, .1 W	91637	CMF-55 T9	119023	1
	R7	Same as R4				
	R8	RESISTOR, CC 150 k 5%, 1/4 W	01121	CB1545	10160401	2
	R9 thru R11	RESISTOR, CC 13 k 5%, 1/4 W	01121	CB1335	10159401	3
	R12	RESISTOR, Set MF 10 k .2%, .1 W	52542	113041	113041	1
	R13	JUMPER	55210	L-2007-1	102879	3
	R14	Part of R12				
	R15	Same as R13				
	R16	Same as R8				
	R17	RESISTOR, MF 100 k 1%, .1 W	81349	RN55D1000F	117589	2
	R18	Same as R17				
	R19	RESISTOR, CC 30 k 5%, 1/4 W	01121	CB3035	10154901	1
	R20	RESISTOR, CC 100 k 5%, 1/4 W	01121	CB1045	10155801	1
	R21	Same as R13				
	R22	Not Used				
	R23	Not Used				
	R24	RESISTOR, CC 1.8 k 5%, 1/4 W	01121	CB1825	10160201	1
	R25	RESISTOR, CC 160 Ω 5%, 1/4 W	01121	CB1615	10174601	1
	RN1	RESISTOR, Network 9-10 k 2%	01121	410A103	119255	2
	RN2	Same as RN1				
	RN3	RESISTOR, Network 8-360 Ω 1%	01121	AB316B361	11982601	1
	RN4	RESISTOR, Network 5-15 k 2%	73138	783-1-R15K	117559	1
	TP1	TEST POINT, Brown	91506	8041-1G3	100521	1
	TP2	Not Used				
	TP3	TEST POINT Orange	91506	8041-1G5	100523	1
	U1	INTEGRATED CIRCUIT Operational Amplifier	27014	LF411CH	11982701	1
	U2	INTEGRATED CIRCUIT, DAC Assembly	24335	ADDAC-08ED	11983101	1

REPLACEABLE PARTS LIST

TITLE A1-A7 DAC-4XX Parent PCB Assembly 07902601 (Cont'd)						
ITEM	REF	COMPONENT DESCRIPTION	MFR'S CODE	MANUFACTURER'S PART NUMBER	SD STOCK NUMBER	T/Q
	U3	INTEGRATED CIRCUIT, CMOS Quad Dual Flip Flop	04713	MC14175BCP	117533	7
	U4	Same as U3				
	U5	INTEGRATED CIRCUIT Voltage Regulator	04713	MC7915CT	103040	1
	U6	INTEGRATED CIRCUIT Voltage Regulator 15 V	04713	MC7815CT	103039	1
	U7	INTEGRATED CIRCUIT Voltage Regulator	04713	MC7805CT	045256	1
	U8	INTEGRATED CIRCUIT Quad Comparator	27041	LM339AN	11940501	1
	U9	INTEGRATED CIRCUIT, CMOS Dual D Flip Flop	01295	SN74HC74N	11983601	1
	U10	INTEGRATED CIRCUIT, CMOS Dual One Shot	27014	MM74C221N	11941001	1
	U11	INTEGRATED CIRCUIT, CMOS 4-16 Line Decoder	01295	SN74HC154	123129	1
	U12	INTEGRATED CIRCUIT, CMOS Hex Inverter	01295	SN74HC04N	11983801	2
	U13	Same as U12				
	U14	INTEGRATED CIRCUIT Dual Opto Coupler	28480	HCPL2730	11983201	2
	U15	Same as U14				
	U16 thru U19	INTEGRATED CIRCUIT Dual Opto Coupler	28480	HCPL2533	11938801	4
	U20	INTEGRATED CIRCUIT Opto Isolator	28480	6N136	103019	1
	U21	INTEGRATED CIRCUIT, TTL SSI 4-2 In Exclusive OR Gate	01295	SN74LS136N	116923	1
	U22	INTEGRATED CIRCUIT, CMOS Quad 2 line - 1 line	01295	SN74HC158N	11983501	1
	U23	INTEGRATED CIRCUIT, TTL Quad 2-Input NAND Gate	01295	SN74LS37N	11984001	3
	U24	INTEGRATED CIRCUIT, CMOS Hex Inverter ST	01295	SN74HC14N	11984101	1
	U25	INTEGRATED CIRCUIT, TTL Quad 2 Input Buffer	01295	SN74LS38N	117514	1
	U26	Same as U23				
	U27	INTEGRATED CIRCUIT, TTL SSI 6-Bit Inverter	01295	SN74LS14N	117083	2
	U28	Same as U27				

REPLACEABLE PARTS LIST

TITLE A1-A7 DAC-4XX Parent PCB Assembly 07902601 (Cont'd)						
ITEM	REF	COMPONENT DESCRIPTION	MFR'S CODE	MANUFACTURER'S PART NUMBER	SD STOCK NUMBER	T/O
	U29	INTEGRATED CIRCUIT, CMOS	01295	SN74HC02N	11983901	1
	U30	Quad 2-Input NOR Gate				
		Same as U23				
	W1	JUMPER	55210	L-2007-1	102879	Ref
	XA1	CONNECTOR, PC	30146	929974-20	116958	2
	XA2	Same as XA1				
	A1	See 07903701 and 07903702 DAC-4XX Assembly				
	A2	See 07903701 and 07903702 DAC-4XX Assembly				
	XU2	SOCKET, IC 16-pin	82647	C8816-01	117041	1

REPLACEABLE PARTS LIST

TITLE DAC-401 Assembly 07903701 Rev A (Figure 7-17)						
ITEM	REF	COMPONENT DESCRIPTION	MFR'S CODE	MANUFACTURER'S PART NUMBER	SD STOCK NUMBER	T/Q
1	A1	ASSEMBLY, DAC-4XX Parent PC	52542	07902601	07902601	Ref
2	A1A1	ASSEMBLY, 12-Bit DAC PC	52542	07902801	07902801	2
	A1A2	Same as A1A1				
4		SCREW, PHMS 4-40 x 3/8	96906	MS51957-15	10062606	4
5		WASHER, Flat No. 4	80205	NAS620-42	100683	4
6		WASHER, Split No. 4	96906	MS35338-135	100711	4
7		ASSEMBLY, Ribbon Cable	52542	06583302	06583302	1
8		FOIL CAL, DAC4XX	52542	079038	079038	1

REPLACEABLE PARTS LIST

TITLE A1A1, DAC-401 12-Bit PC Assembly 07902801 Rev A (Figure 7-20)						
ITEM	REF	COMPONENT DESCRIPTION	MFR'S CODE	MANUFACTURER'S PART NUMBER	SD STOCK NUMBER	T/Q
1		BOARD, PC	52542	079028	079028	1
	C1	CAPACITOR, Ceramic 10 pF 5%, 100 V	96733	DB44BY100J	117621	1
	C2	CAPACITOR, Ceramic 1 μ F 20%, 50 V	56289	5CZ5U105X0050C5	100176	2
	C3	Same as C2				
	C4	CAPACITOR, DP Ceramic 0.001 μ F 10%, 100 V	04222	3418100C102K	117568	1
	CR1	DIODE, Signal 70 V	28480	5082-2800	100442	1
	P1	CONNECTOR, PC Header	30146	929834-01-20	116957	1
	R1	RESISTOR, Variable 50 k 10%, 3/8 W	73138	89PR50K	102153	1
	R2	RESISTOR, Variable 200 Ω 10%, 3/8 W	73138	89PR200	102120	1
	R3	RESISTOR, CC 100 Ω 5%, 1/4 W	01121	CB1015	101609	1
	R4	RESISTOR, Metal Film 100 k 1 Ω , 0.1 W	81349	RN55C1003F	102525	1
	R5	RESISTOR, Metal Film 137 Ω 1%, 1/8 W	81349	RN55D1370F	11992801	1
	R6	RESISTOR, MF 100 k 1%, .1 W	81349	RN55D1000F	117589	1
	R7	RESISTOR, CC 10 k 5%, 1/4 W	01121	CB1035	10157001	1
	TP1	TEST POINT Yellow	91506	8041-1G2	100524	1
	U1	INTEGRATED CIRCUIT Operational Amplifier	27014	LF411CH	11982701	1
	U2	INTEGRATED CIRCUIT DAC Assembly	24335	AD567JD	11965601	1
	W1	JUMPER	55210	L-2007-1	102879	1
	XU2	SOCKET, IC 28-pin	73803	C9828-01	11984201	1

REPLACEABLE PARTS LIST

TITLE DAC-402 Assembly 07903702 Rev A (Figure 7-18)						
ITEM	REF	COMPONENT DESCRIPTION	MFR'S CODE	MANUFACTURER'S PART NUMBER	SD STOCK NUMBER	T/Q
1	A1	ASSEMBLY, DAC-4XX Parent	52542	07902601	07902601	Ref
2	A1A1	ASSEMBLY, 12-Bit DAC PC	52542	07902801	07902801	1
3	A1A2	ASSEMBLY, 16-Bit DAC PC	52542	07902901	07902901	1
4		SCREW, PHMS 4-40 x 3/8	96906	MS51957-15	10062606	4
5		WASHER, Flat No. 4	80205	NAS620-42	100683	4
6		WASHER, Split No. 4	96906	MS35338-135	100711	4
7		ASSEMBLY, Ribbon Cable	52542	06583302	06583302	1
8		FOILCAL, DAC4XX	52542	079038	079038	1

REPLACEABLE PARTS LIST

TITLE A1A2, DAC-402 16 Bit PC Assembly 07902901 Rev A (Figure 7-22)						
ITEM	REF	COMPONENT DESCRIPTION	MFR'S CODE	MANUFACTURER'S PART NUMBER	SD STOCK NUMBER	T/Q
1		BOARD, PC	52542	079029	079029	1
	C1	CAPACITOR, Ceramic 1 μ F 20%, 50 V	56289	5CZ5U105X0050C5	100176	3
	C2	CAPACITOR, DP Ceramic 0.01 μ F 20%, 100 V	04222	3429100C103M	117570	1
	C3	CAPACITOR, Ceramic 10 pF 5%, 100 V	96733	DB44BY100J	117621	1
	C4	Same as C1				
	C5	Same as C1				
	P1	CONNECTOR, PC Pin	30146	929834-01-20	116957	1
	R1	RESISTOR, Variable 10 k 10%, 3/8 W	73138	89PR10K	102472	1
	R2	RESISTOR, Variable 20 k 10%, 3/8 W	73138	89PR20K	102470	1
	R3	RESISTOR, CC 100 Ω 5%, 1/4 W	01121	CB1015	10160901	1
	R4	RESISTOR, Metal Film 249 k Ω 1%, 0.1 W	81349	RN55E2493F	118928	1
	R5	RESISTOR, Metal Film 118 Ω 1%, .1 W	91637	CMF 55 T1	11982901	1
	R6	RESISTOR, CC 10 k Ω 5%, 1/4 W	01121	CB1035	10157001	1
	TP1	TEST POINT Yellow	91506	8041-1G2	100524	1
	U1	INTEGRATED CIRCUIT Operational Amplifier	27014	LF411CH	11982701	1
	U2	INTEGRATED CIRCUIT DAC Assembly	52542	123127	123127	1
	U3 thru U6	INTEGRATED CIRCUIT, CMOS Quad D F-F W/Clear	01295	SN74HC175	123128	4
	XU2	SOCKET, 24-pin	91506	524-AG11D	11933801	1

REPLACEABLE PARTS LIST

TITLE Ribbon Cable Assembly 06583302 Rev A						
ITEM	REF	COMPONENT DESCRIPTION	MFR'S CODE	MANUFACTURER'S PART NUMBER	SD STOCK NUMBER	T/Q
1		CABLE, Flat	76381	3365/25	11991101	1
2		CONNECTOR, Rectangular	02660	841-17-DBFR-B25S	11981401	1
3		CONNECTOR, Rectangular 24-Pin	53387	3460-0000T	11941301	1
4		SPRING, Connector Latch	71468	D110277	11981701	1
5		SCREW, PHMS 4-40 x 3/8	96906	MS51957-15	10062606	2
6		NUT, Kep 4-40	78189	511-041800-00	100941	2

REPLACEABLE PARTS LIST

TITLE Option T2 Transformer Cable Assembly 07900201 Rev A						
ITEM	REF	COMPONENT DESCRIPTION	MFR'S CODE	MANUFACTURER'S PART NUMBER	SD STOCK NUMBER	T/Q
1	T2	TRANSFORMER	52542	504369	504369	1
4	T2P1	CONNECTOR, Rectangular 3-pos	27264	22-01-3037	11958401	1
5		CONNECTOR, Termination	27264	05-02-0048	116548	3
7		CONNECTOR, Termination	27264	05-02-0048	116548	4
8		WRAP, Spiral 1/8D	06383	T12F	11980502	A/R
10		TIE, Cable	96906	MS33674-9	100753	A/R
11		NUT, Hex 8-32	78189	51-101800-01	100940	2

CHAPTER 7

DRAWINGS

7-1. INTRODUCTION

7-2. This chapter contains the assembly and schematic diagrams for the Model's P6/P12 Power Supplies. The parts list

contained in chapter 6 relates to the reference designation callouts on the diagrams. Table 7-1 provides a list by figure number of the drawings, with title, drawing number and page number.

Table 7-1. List of Drawings

Figure Number	Drawing Title	Drawing Number	Page Number
7-1	P6 Shipping Assembly	06580301	7-2
7-2	Top Cover Assembly	06597601	7-3
7-3	Front Panel Assembly	06581601	7-4
7-4	PCB Support Bracket Assembly	06582101	7-5
7-5	PCB Support Bracket Assembly	06582201	7-6
7-6	A2, Bus Board PC Assembly	06579601	7-7
7-7	A1, +5V Power Supply Assembly	06924502	7-8
7-8	A1A1, +5V Power Supply PC Assembly	06917802	7-9
7-9	A1A1, +5V Power Supply Schematic	06918002	7-9
7-10	P6, Test Assembly	06576901	7-11
7-11	P6, Schematic	06576801	7-13
7-12	A2A1, DAC-4 PC Assembly	06576501	7-14
7-13	A2A1, DAC-4 PC Assembly Schematic	06576401	7-15
7-14	A2A0, Interface PC Assembly	06577501	7-16
7-15	A2A0, Interface PC Assembly Schematic	06577601	7-17
7-16	DAC-4XX Parent PCB Assembly	07902601	7-18
7-17	DAC-401 Assembly	07903701	7-18
7-18	DAC-402 Assembly	07903702	7-18
7-19	DAC-400 Series Schematic	07902601	7-19
7-20	DAC-400 Series 12-Bit PC Assembly	07902801	7-20
7-21	DAC-400 Series 12-Bit Schematic	07902801	7-20
7-22	DAC-400 Series 16-Bit PC Assembly	07902901	7-21
7-23	DAC-400 Series 16-Bit Schematic	07902901	7-21

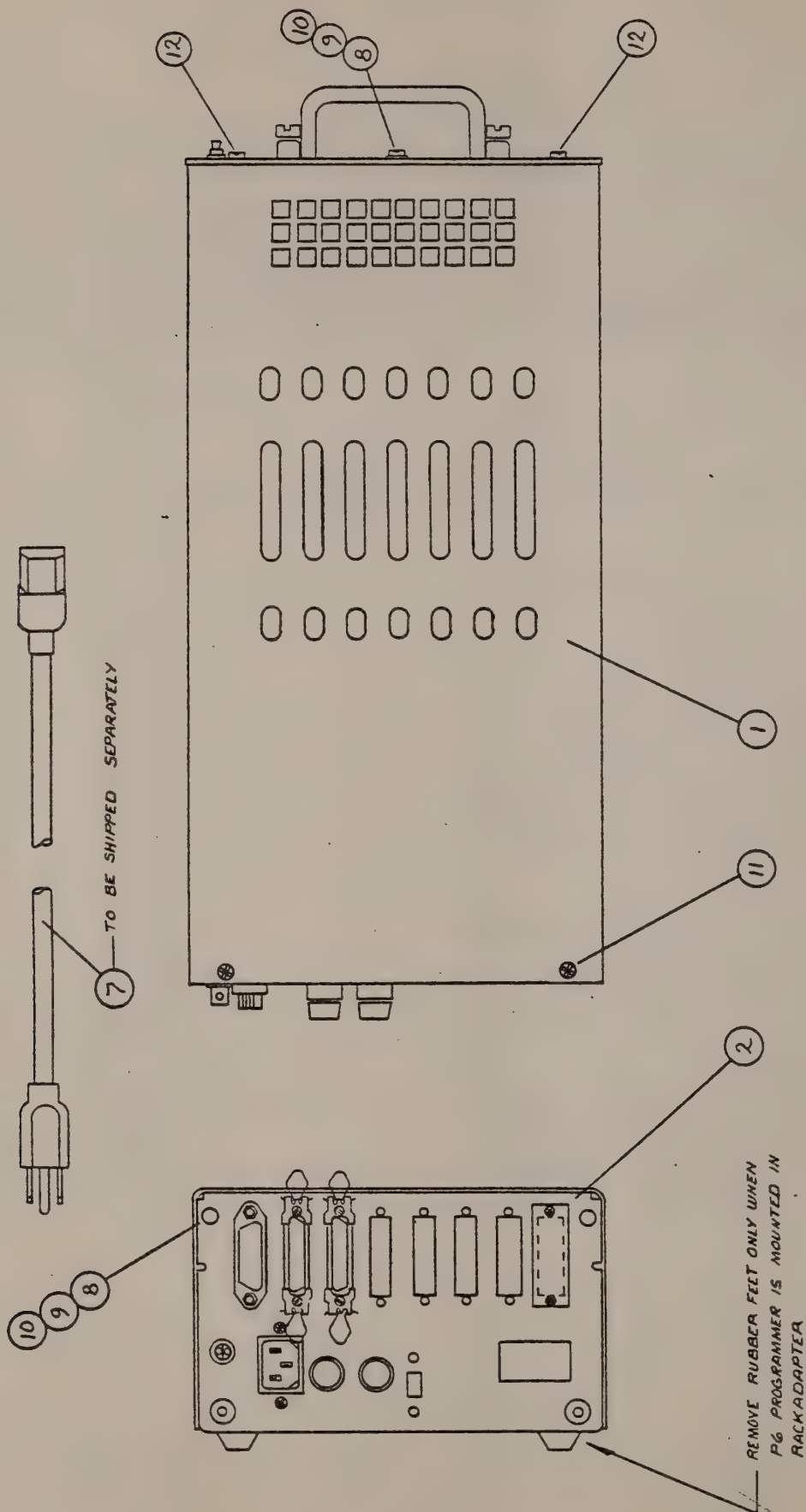
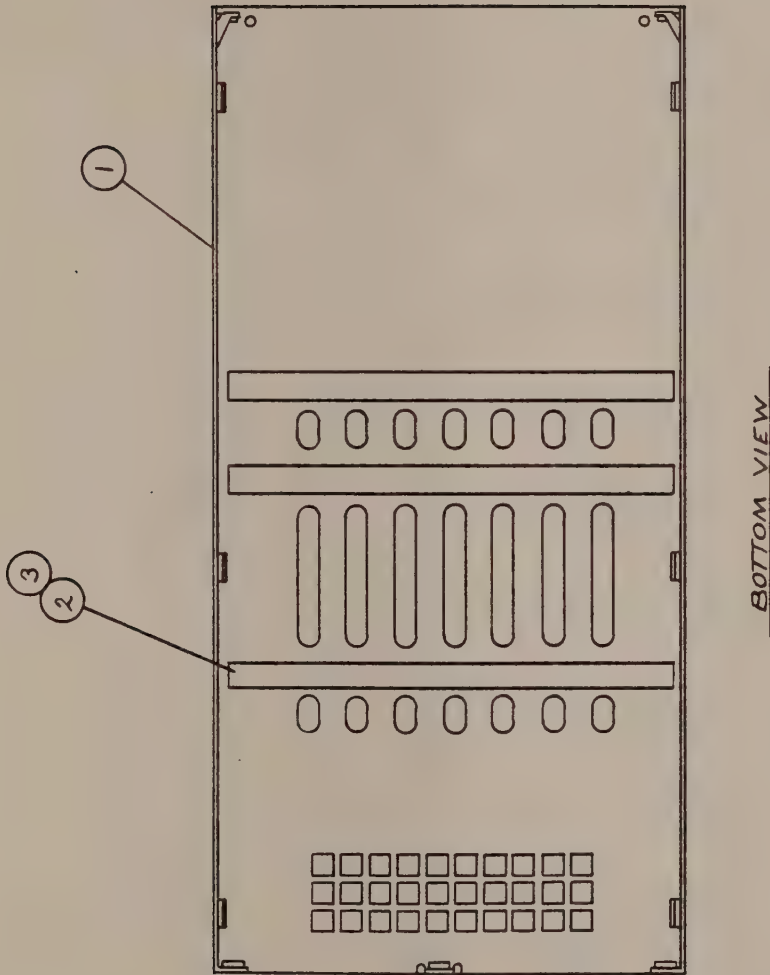


Figure 7-1
P6 Shipping Assembly
06580301 Rev C



BOTTOM VIEW

Figure 7-2
Top Cover Assembly
06597601 Rev A

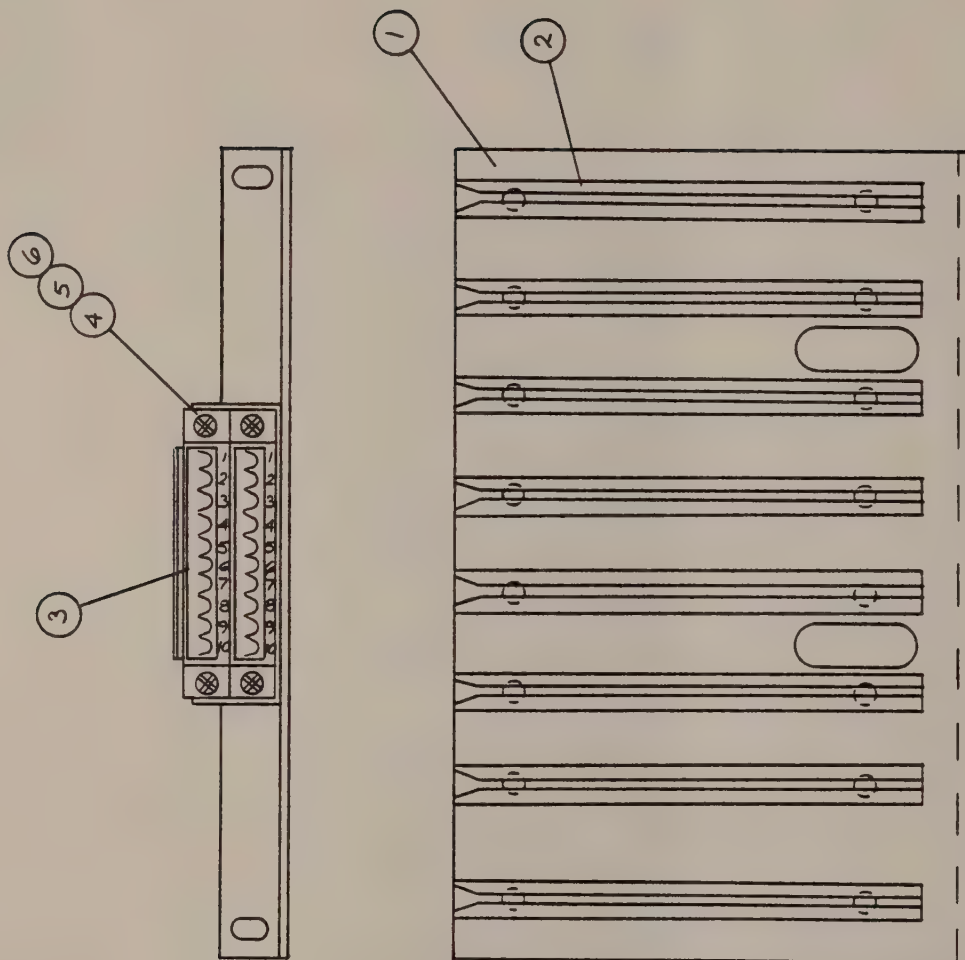
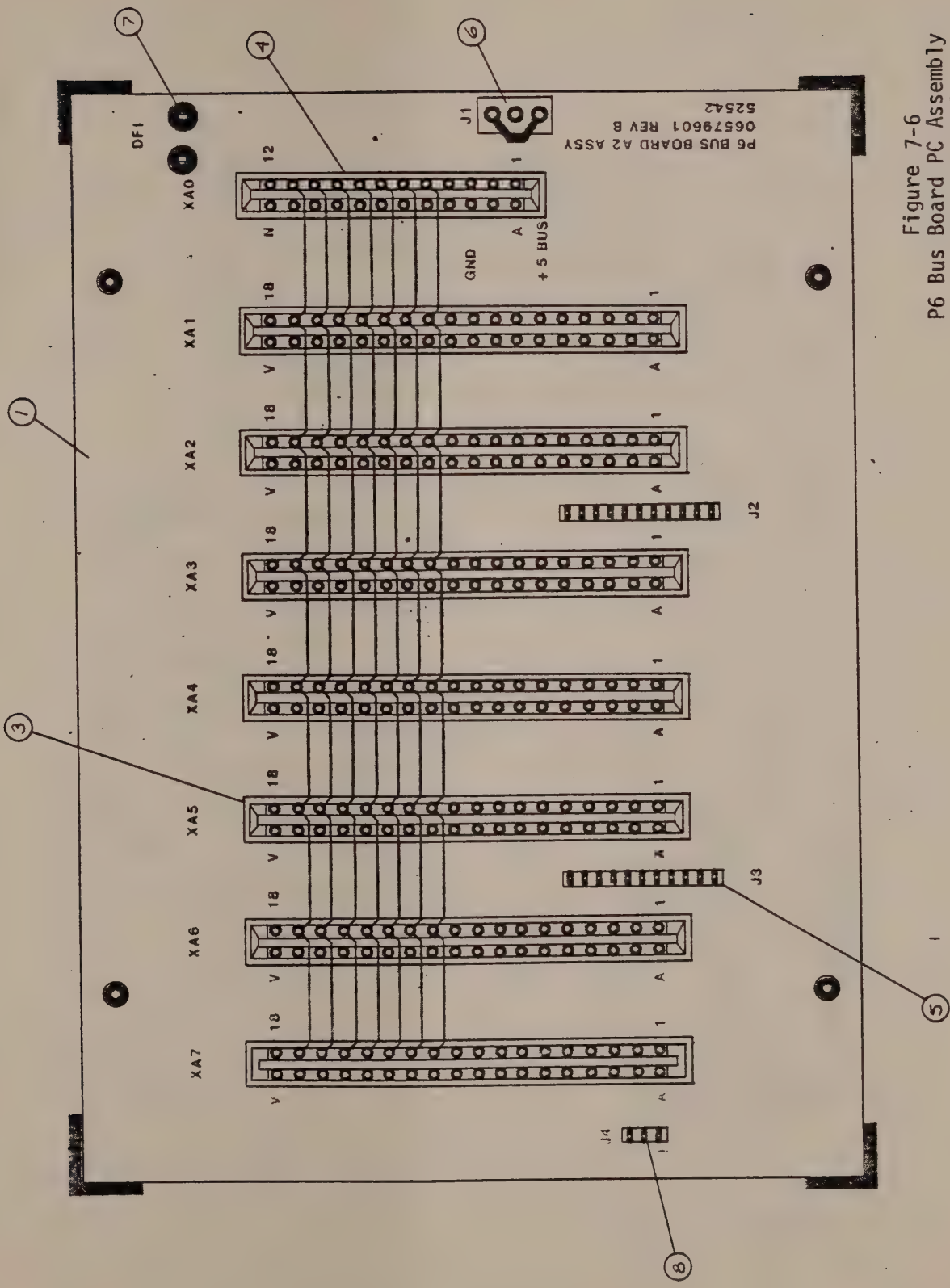
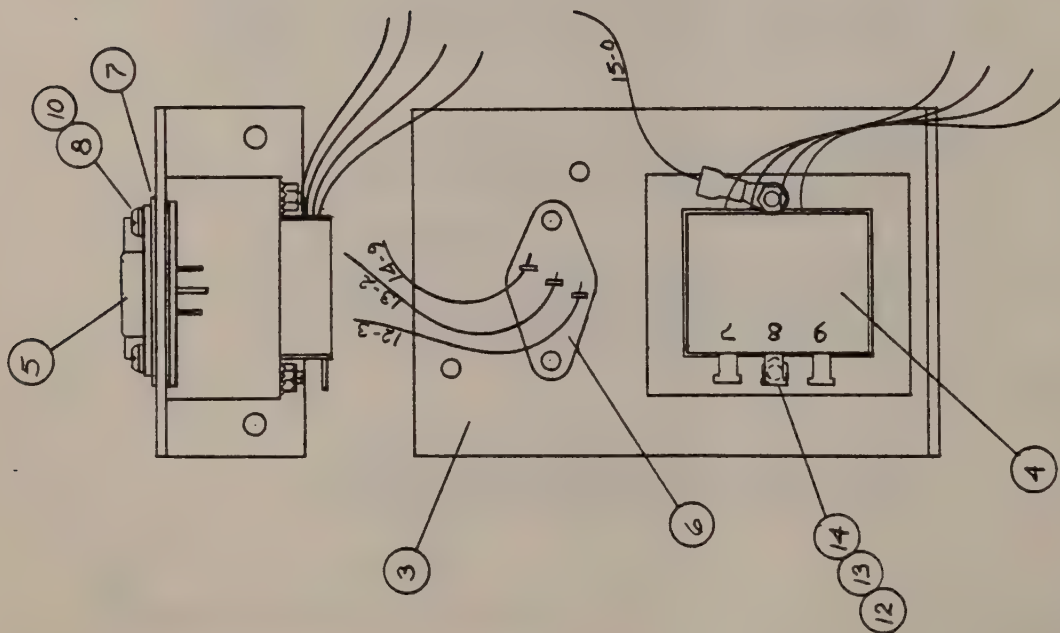


Figure 7-5
PCB Support Bracket Assembly
06582201 Rev A



P6 BUS BOARD A2 ASSY
06579601 REV B
52542

Figure 7-6
P6 Bus Board PC Assembly
06579601 Rev B



NOTE: 1) USE THERMAL COMPOUND P/N 100750 ON U1

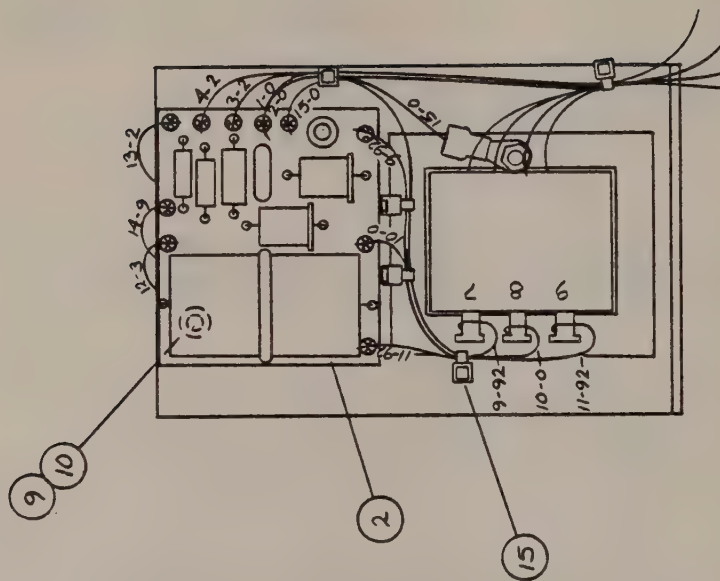


Figure 7-7
+5V Power Supply Assembly
06924502 Rev A

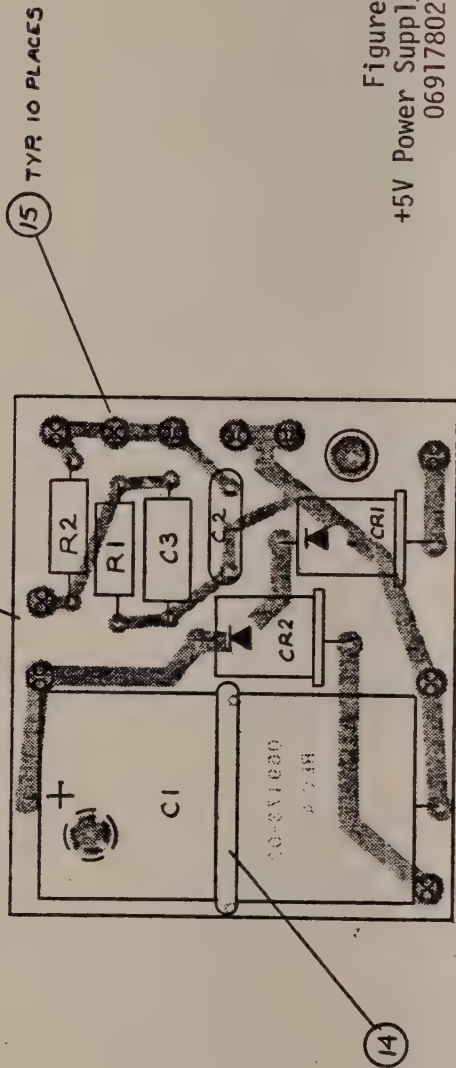
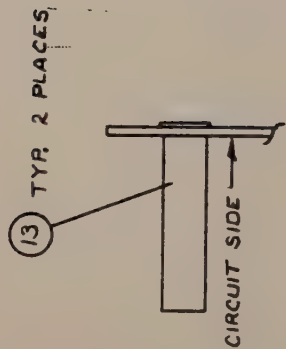
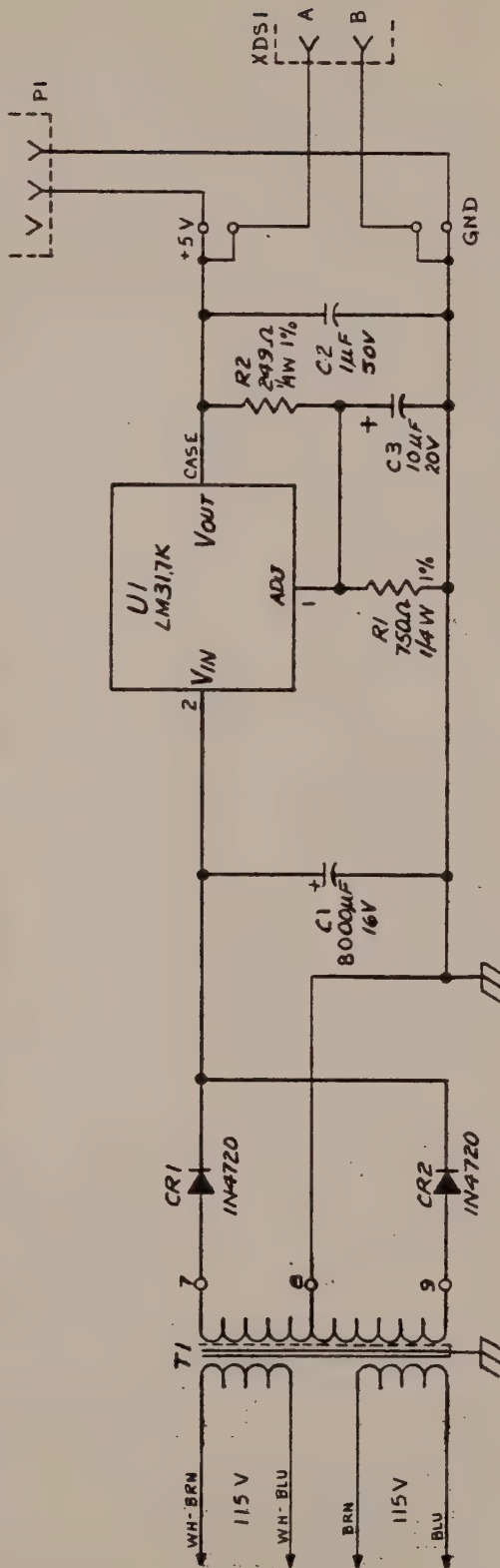


Figure 7-8
+5V Power Supply PC Assembly
06917802 Rev A



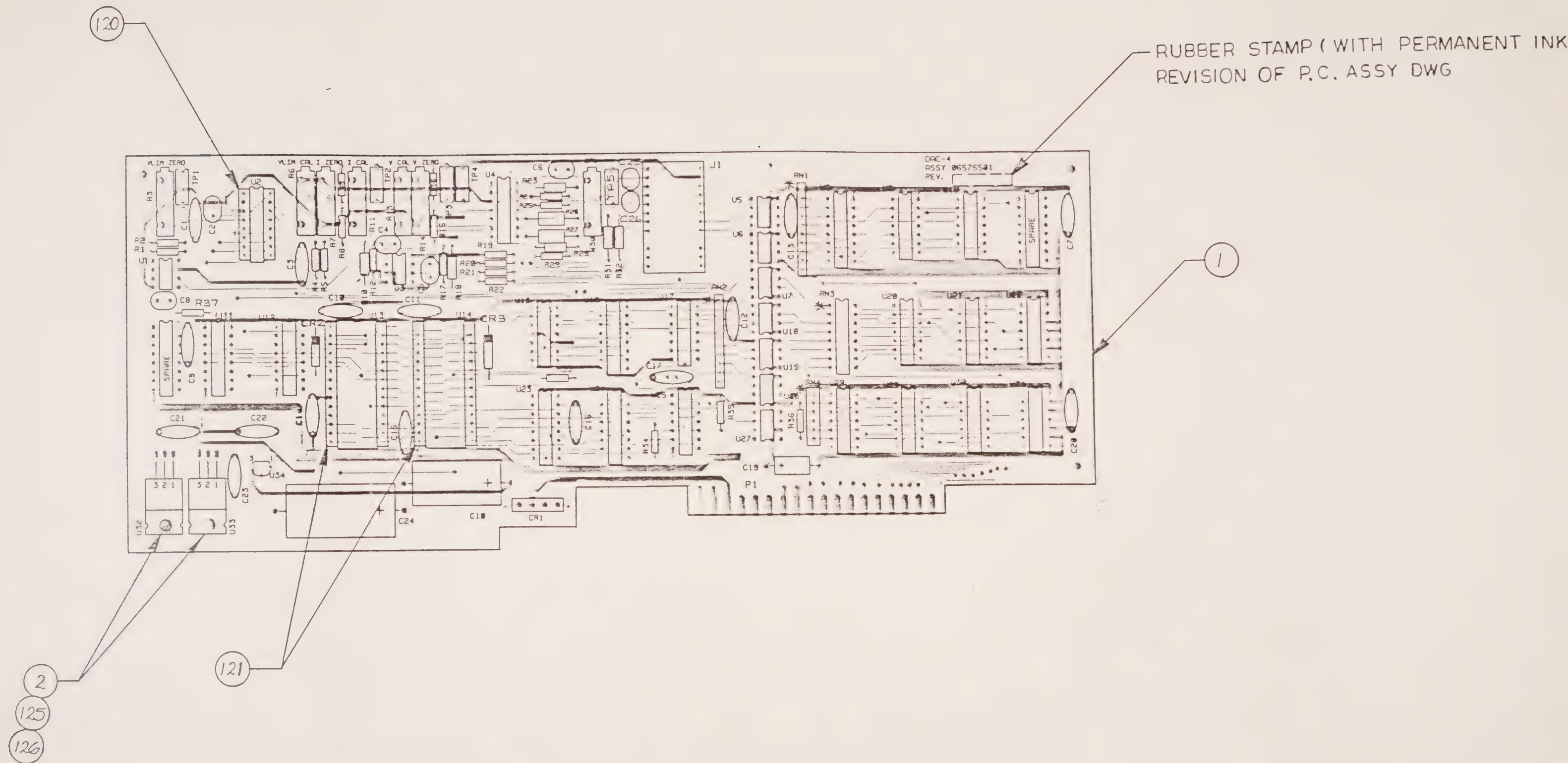


Figure 7-12
DAC-4 PC Assembly
06576501 Rev B

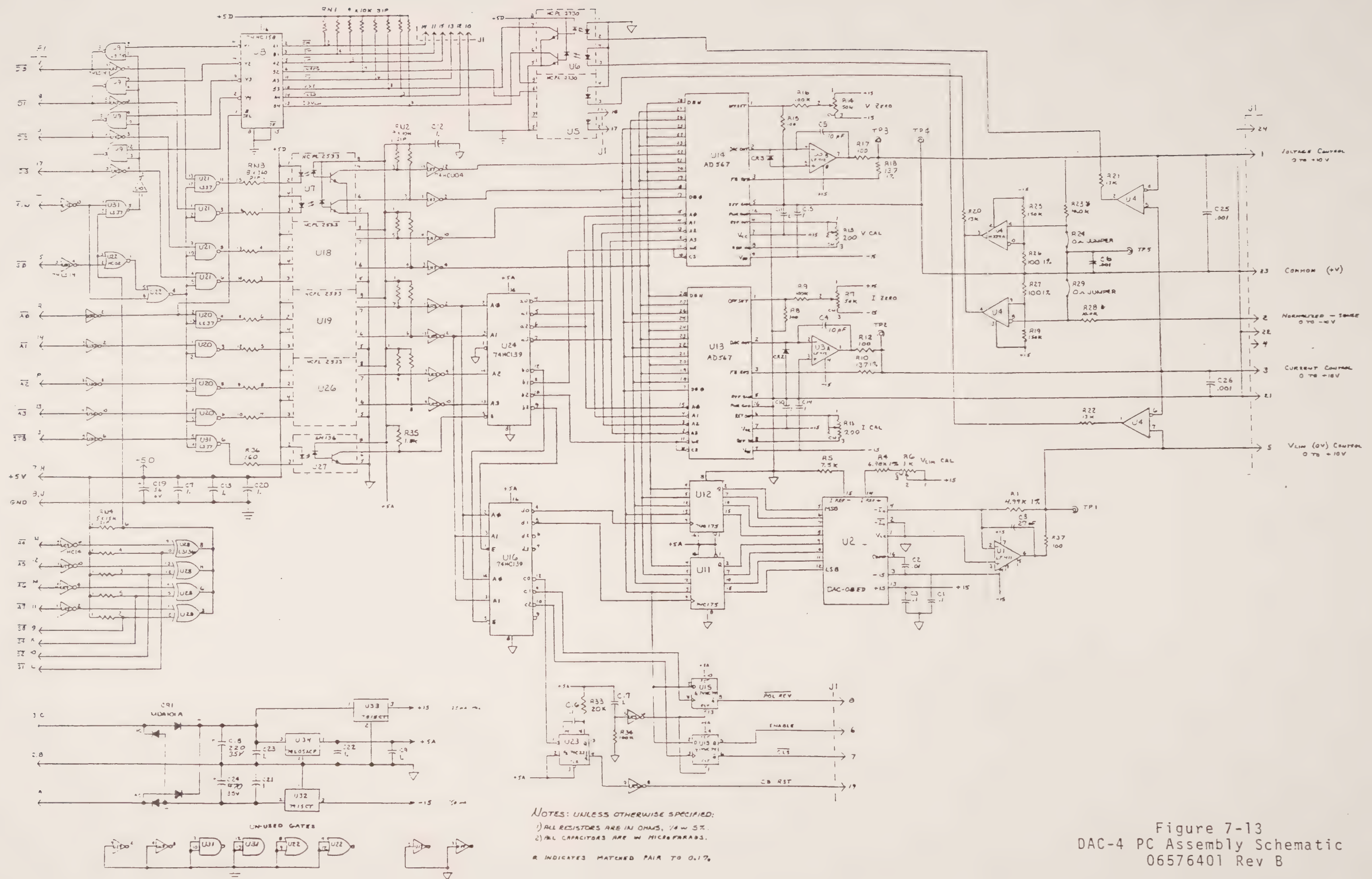


Figure 7-13
DAC-4 PC Assembly Schematic
06576401 Rev B

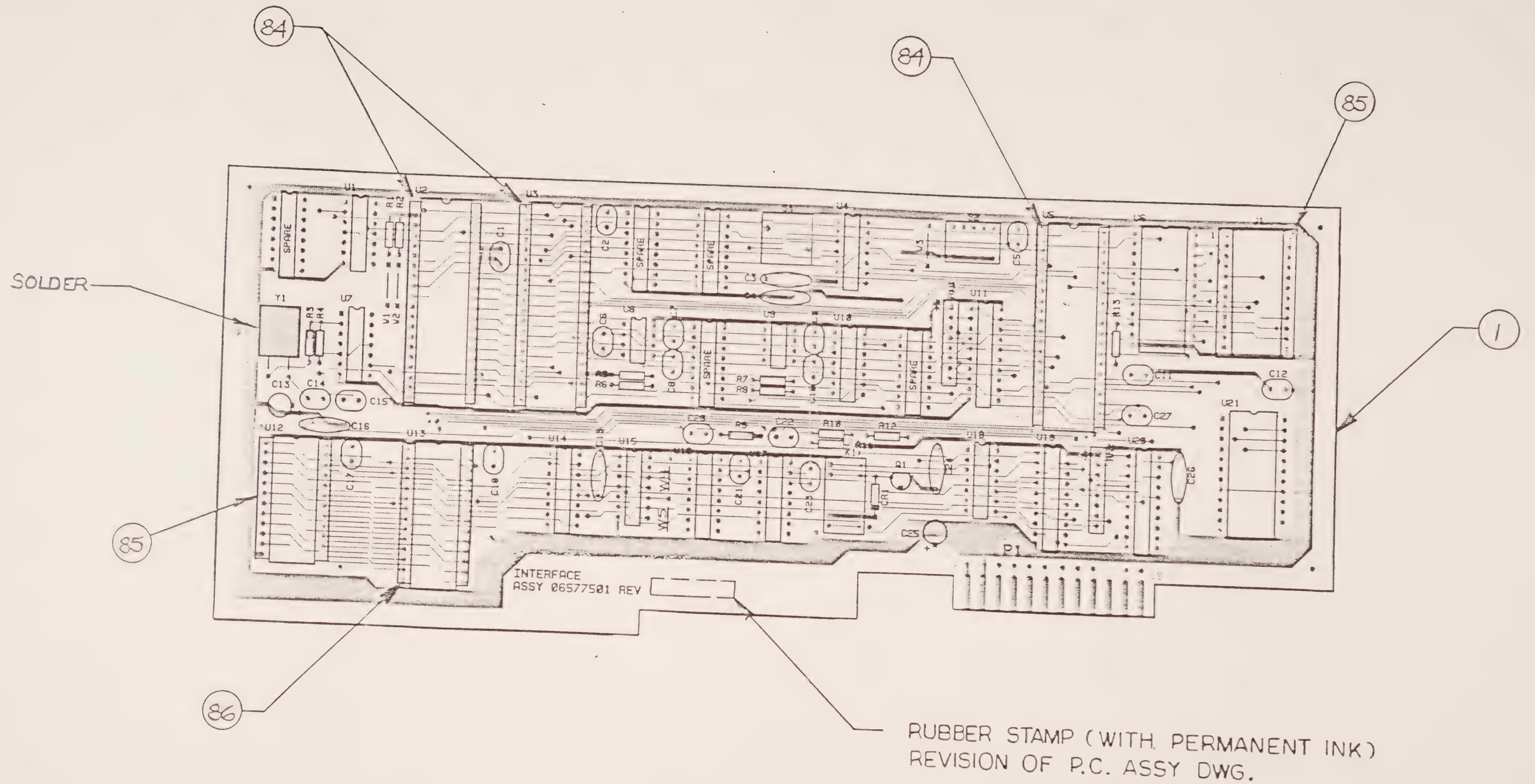
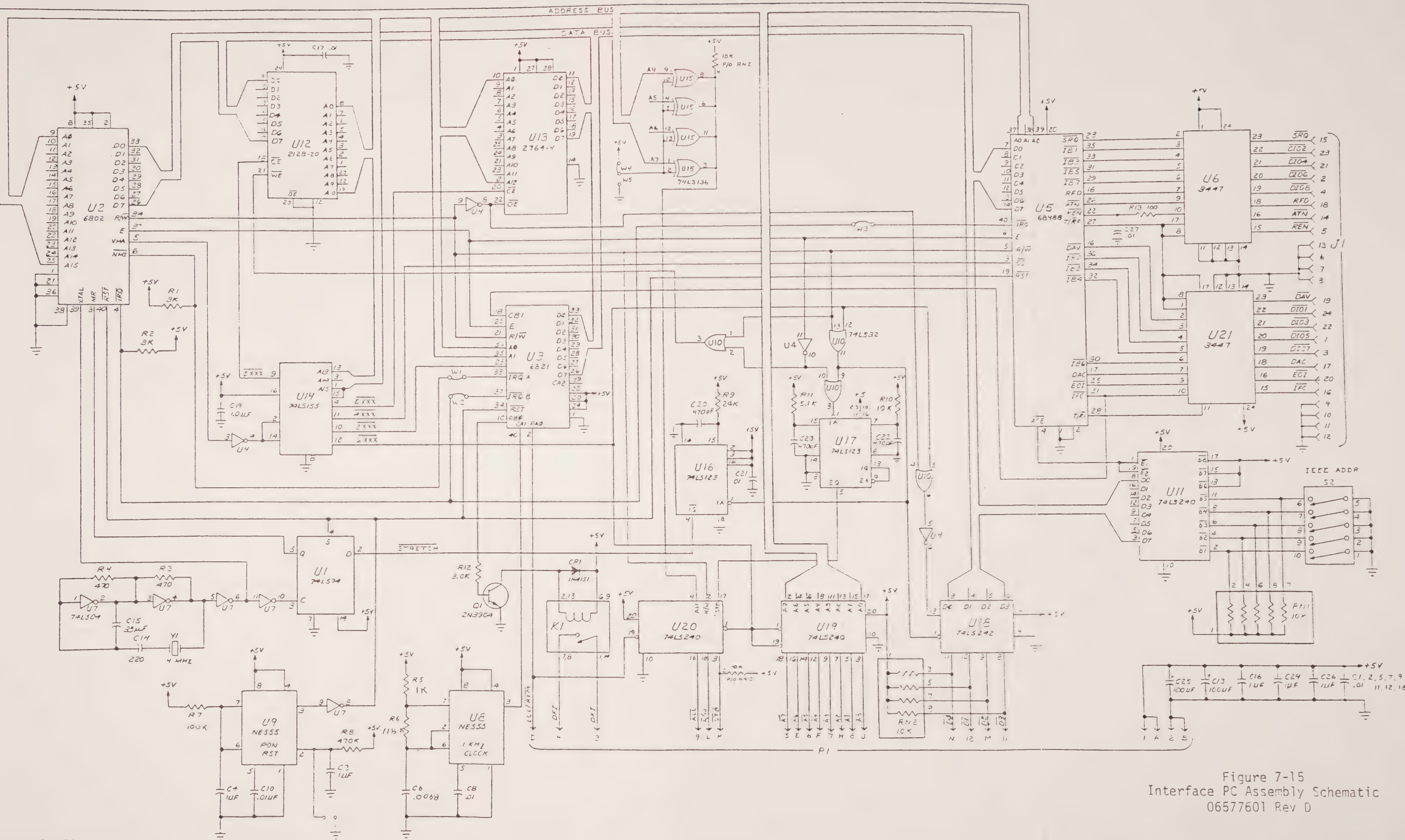


Figure 7-14
Interface PC Assembly
06577501 Rev D



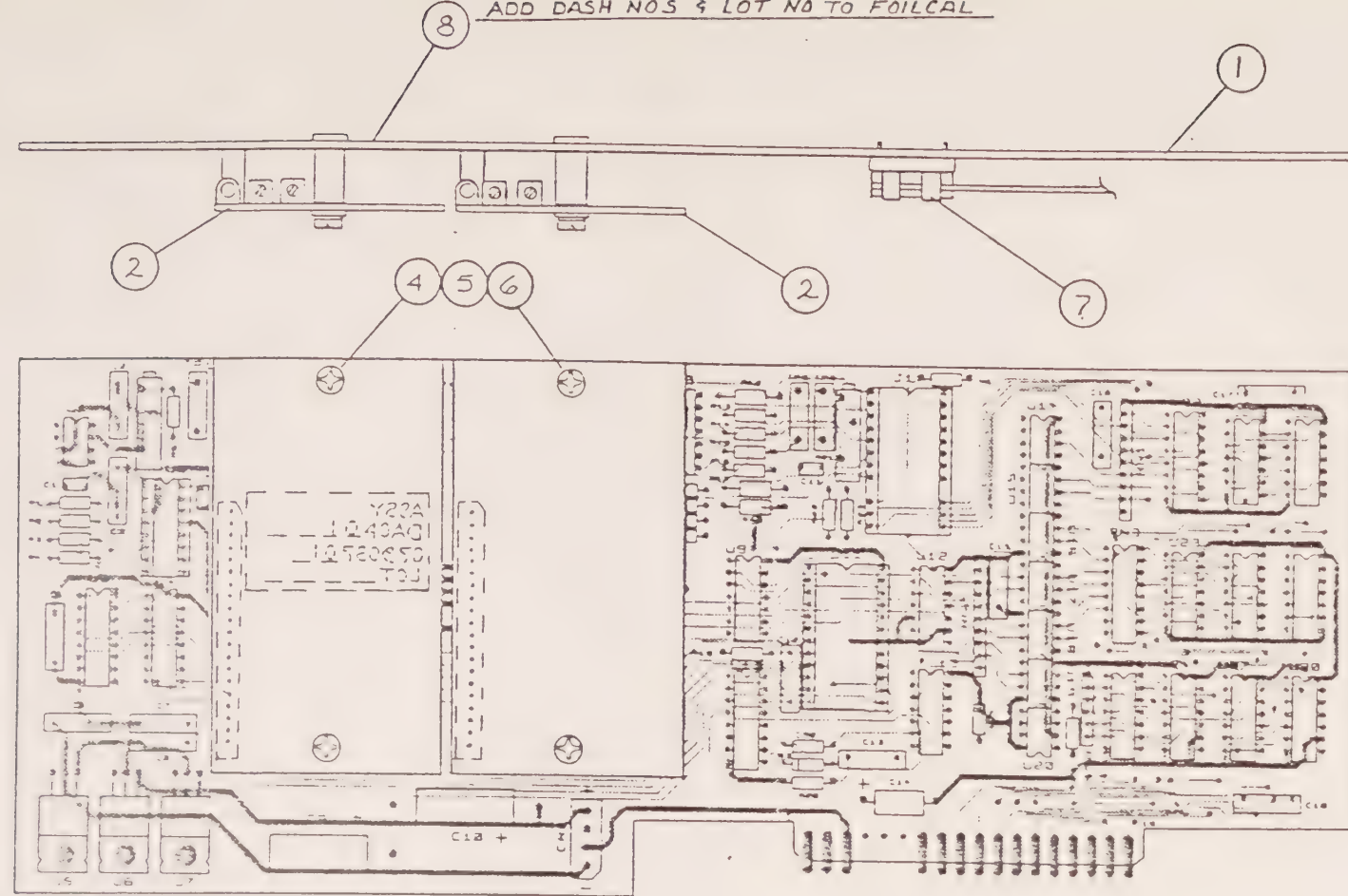


Figure 7-17
DAC 401 Assembly
07903701 Rev A

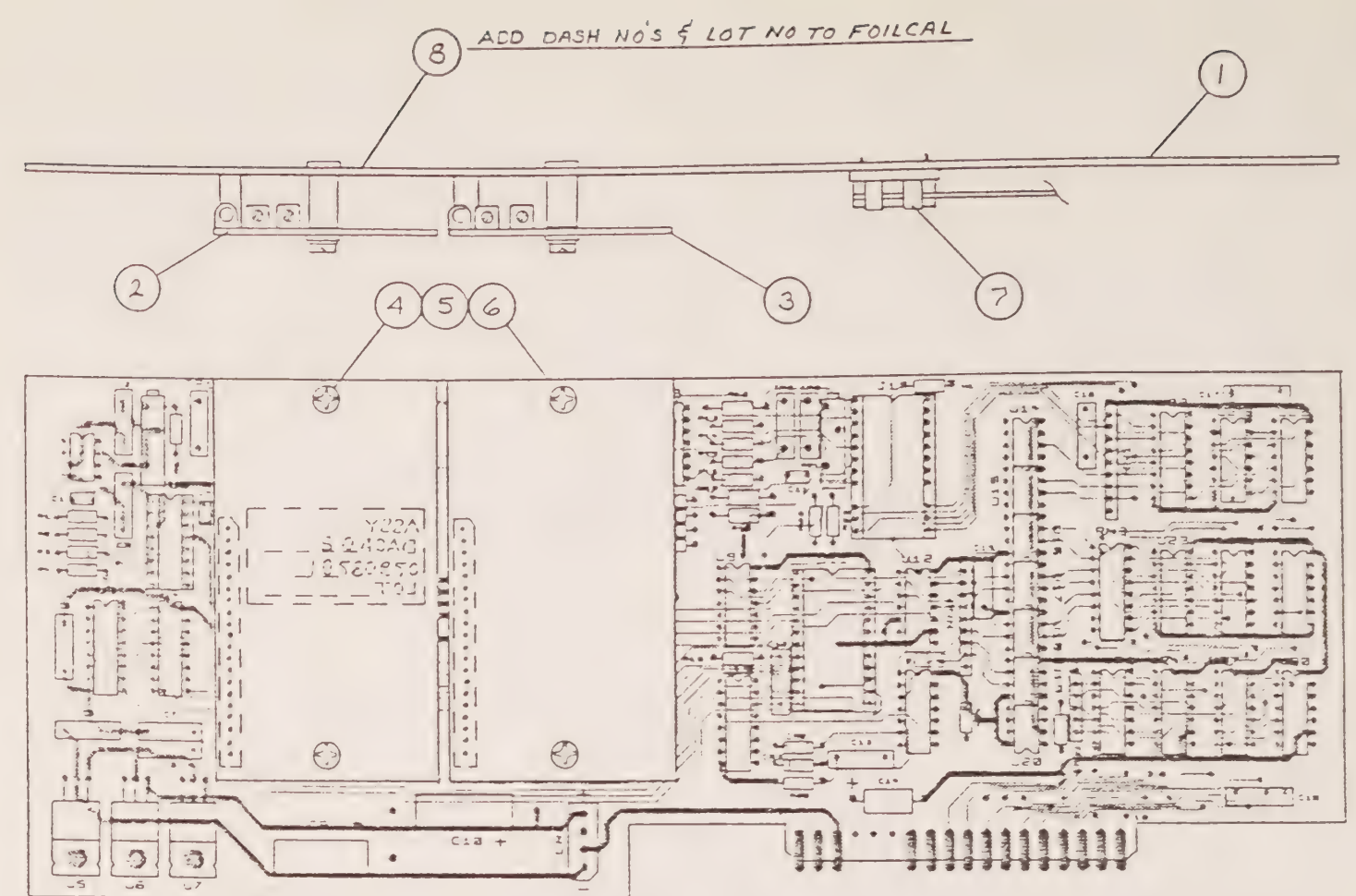


Figure 7-18
DAC 402 Assembly
07903702 Rev A

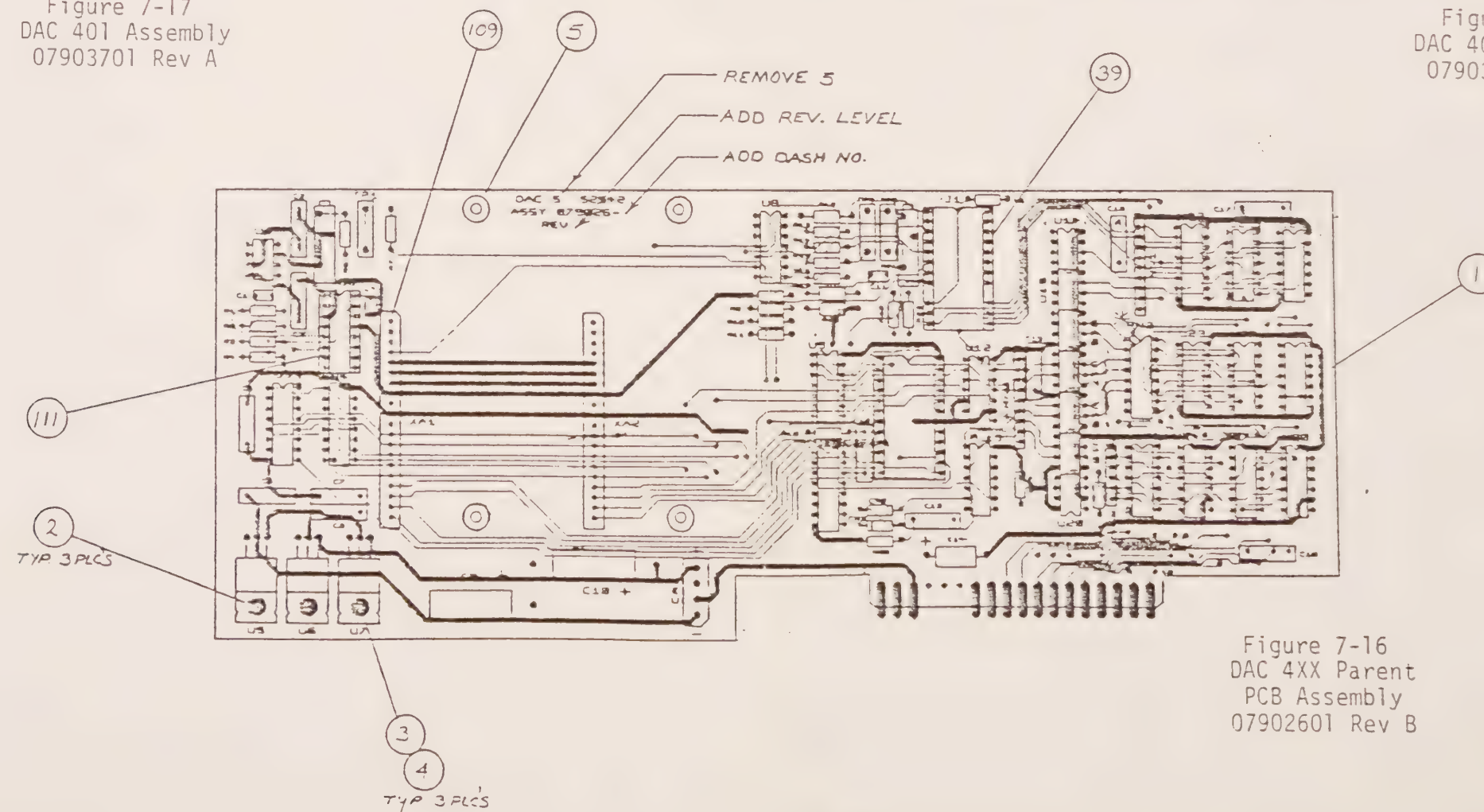
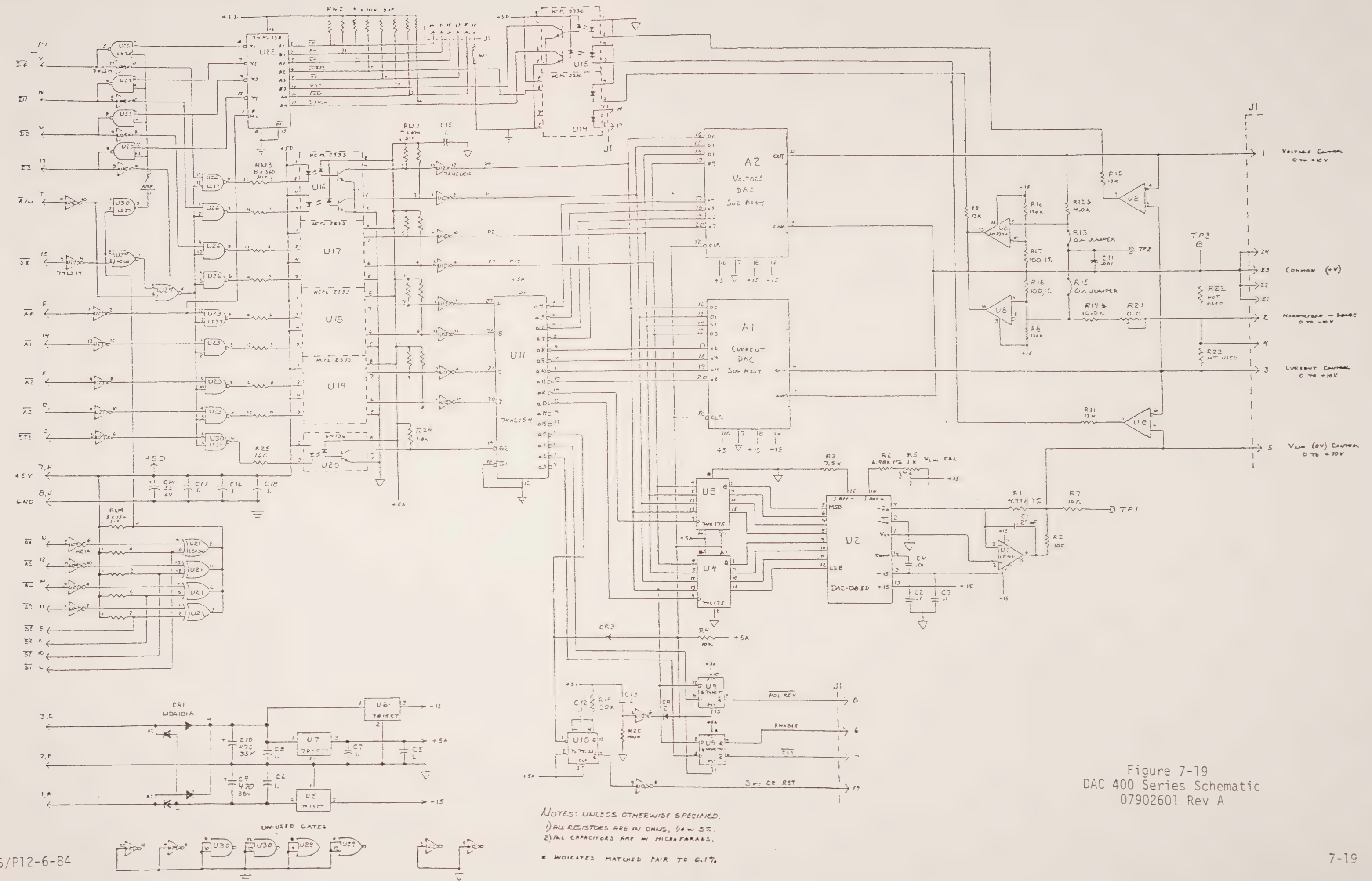


Figure 7-16
DAC 4XX Parent
PCB Assembly
07902601 Rev B



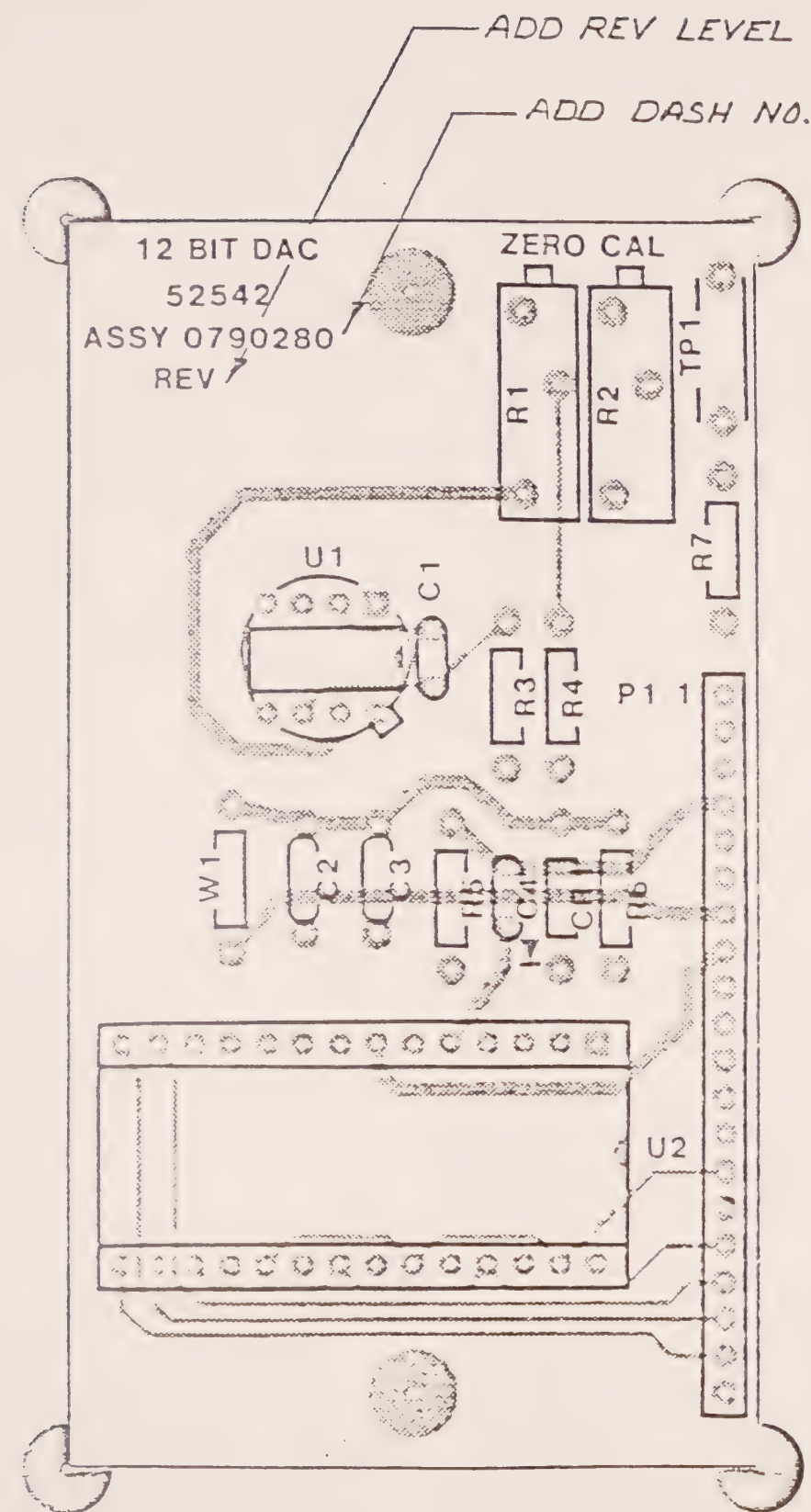


Figure 7-20
DAC 400 Series
12-Bit DAC PC Assembly
07902801 Rev A

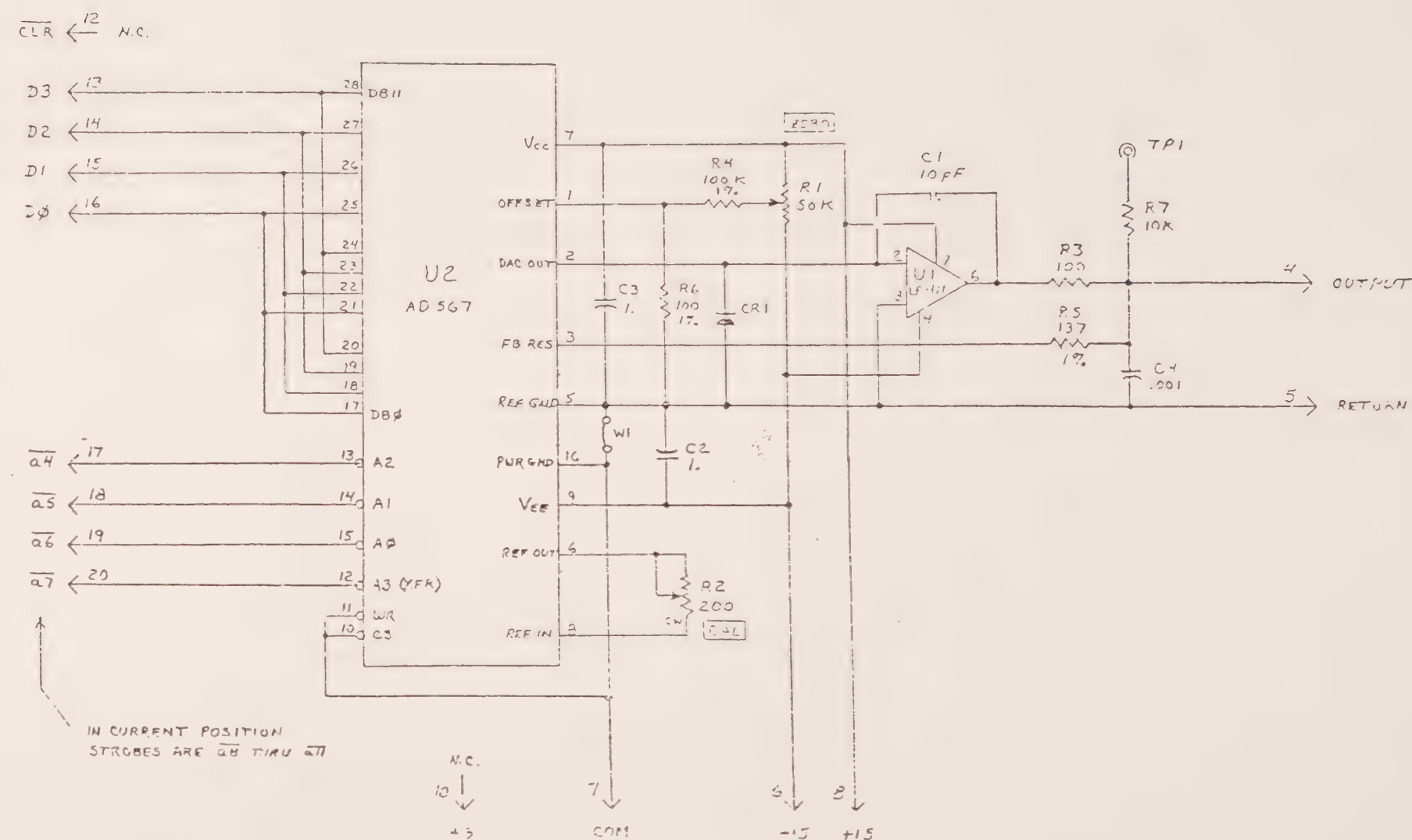


Figure 7-21
DAC 400 Series
12-Bit DAC Schematic
07902801 Rev A

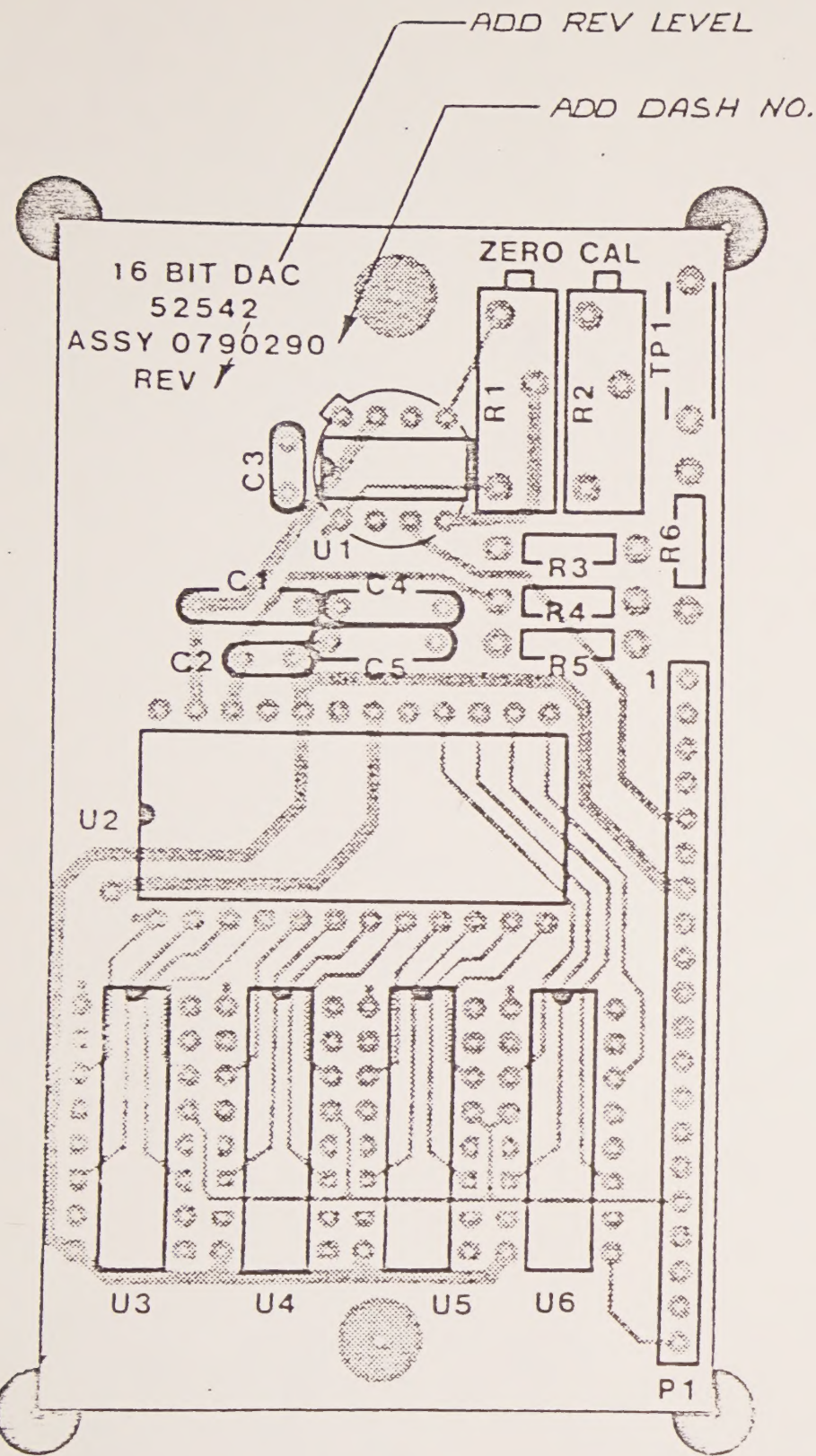


Figure 7-22
DAC 400 Series
16-Bit DAC PC Assembly
07902901 Rev A

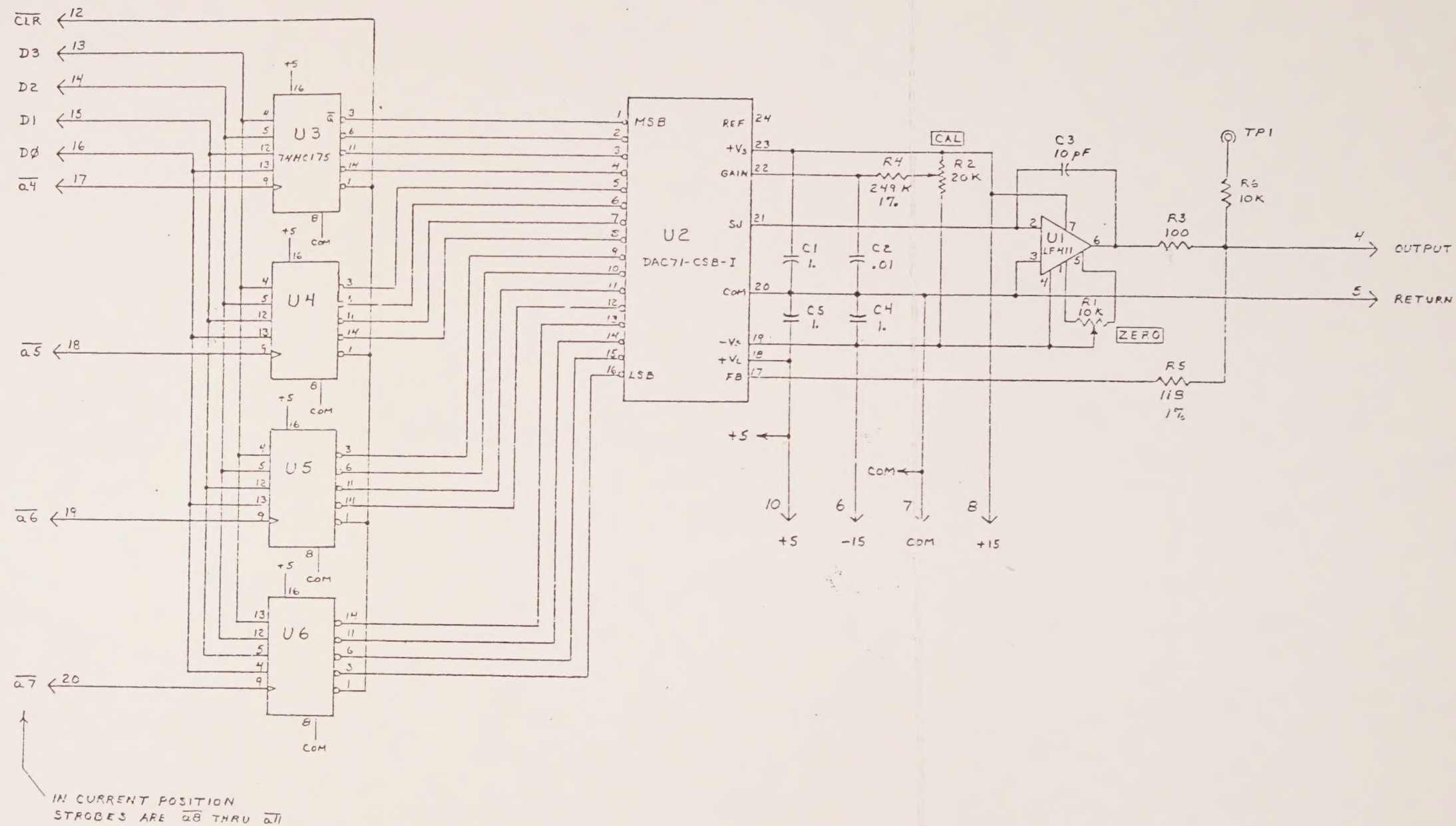


Figure 7-23
DAC 400 Series
16-Bit DAC Schematic
07902901 Rev A

www.manualsplus.com



1025321